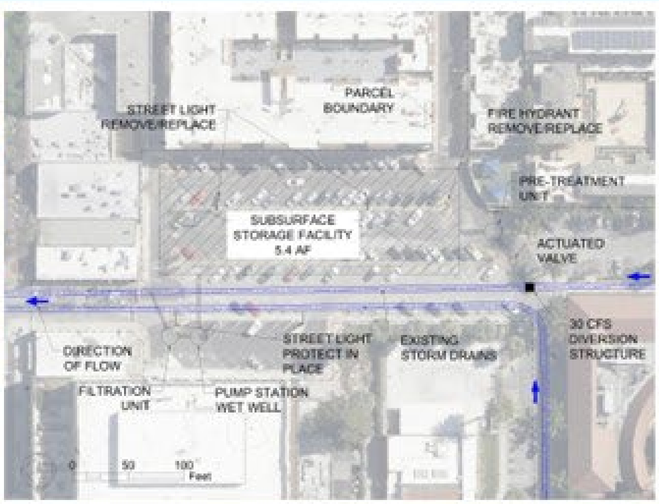
OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

C/CAG
City/County Association of Governments of San Mateo County

Concept Design Report

Redwood City City Hall

May 31, 2022



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craftwater engineering, inc.

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

CONCEPT DESIGN REPORT

REDWOOD CITY CITY HALL PROJECT

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PRESENTED TO

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ac-ft	acre-feet
BMP	Best Management Practice
cfs	cubic feet per second
EPA	Environmental Protection Agency
EWMP	Enhanced Watershed Management Program
ft	feet
GIS	Geographic Information System
hr	hour
in	inch
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LiDAR	Light Detection and Ranging
LSGR	Lower San Gabriel River
LSGR WMP	Lower San Gabriel River Watershed Management Program
LSPC	Loading Simulation Program C++
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NSF	National Sanitation Foundation
O&M	Operations and Maintenance
RAA	Reasonable Assurance Analysis
RWL	Receiving Water Limit
SUSTAIN	System for Urban Stormwater Treatment and Analysis IntegratioN
TMDL	Total Maximum Daily Loads
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBEL	Water Quality-Based Effluent Limit

1.0 INTRODUCTION AND EXISTING CONDITIONS

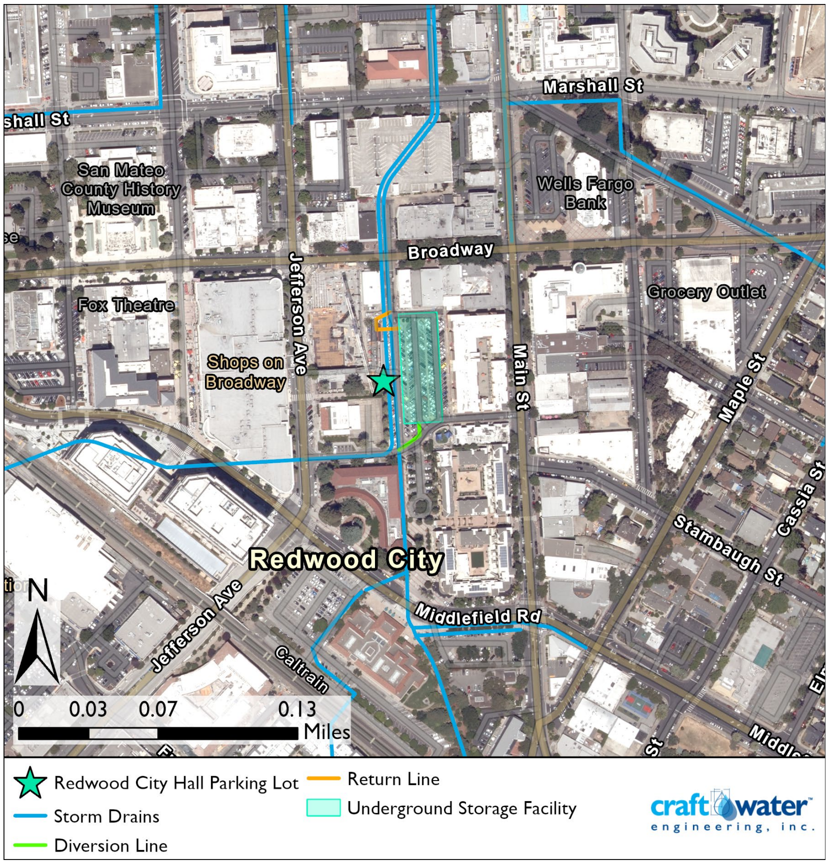


Figure 1-1. Project location.

To address the requirements of the Municipal Regional Permit (MRP), the County of San Mateo, City/County Association of Governments of San Mateo County (C/CAG) and other agencies are collaborating to determine the most impactful and effective ways to capture stormwater and improve water quality in managed watersheds that include their jurisdiction. The MRP, a Phase I municipal stormwater permit, was issued by the San Francisco Bay Regional Water Quality Control Board and includes requirements for Permittees to address regional water quality issues including trash loading and TMDLs (Total Maximum Daily Loads) for mercury and PCBs (polychlorinated biphenyls) as part of the San Francisco Bay Basin Plan. To provide required pollutant reductions and contribute to other regional watershed management goals (flood management, green infrastructure, water reuse, etc.), C/CAG has taken a progressive approach to achieve compliance with the MRP in a cost-efficient manner by promoting multi-benefit projects and leveraging collaboration and funding sources. C/CAG's recently completed Regional Collaborative Program Framework White Paper (C/CAG, 2022) identified regional project opportunities throughout the County that can support regional-scale programmatic implementation of green infrastructure at a distributed scale.

A regional stormwater capture project is proposed at the Redwood City City Hall Parking Lot owned by Redwood City. The map above (Figure 1-1) shows the location of the proposed project. The project is intended to intercept the dry-weather flow and a sizeable portion of the stormwater flows from one of the two adjacent storm drains to a subsurface storage structure under a parking lot. Stormwater will be diverted from a storm drain running south to north along a driveway in the parking lot. The site location proposes several technical design decisions that will be addressed in this document, including the following:

- Stormwater Diversion Location
- Pump Station Considerations/Necessity
- Best Management Practice (BMP) Type and Configuration

Each of these components of design for this project have been evaluated with emphases on feasibility, constructability, cost-effectiveness, and water quality impact. The full range of options for this project has been assessed to ensure that final design recommendations best match desired outcomes for the project and provide the maximum benefit given site constraints. Additional considerations for the project have been evaluated to ensure that the final design considers community impact and enhancement, regional water reuse efforts, and ongoing operations and maintenance costs. Details of this process and the findings can be found herein.

1.1 PROJECT OBJECTIVES

The objective of this report is to provide 10% design-level documents that will ultimately guide the development of the 100% detailed design documents and project implementation. The project concepts presented herein will be optimized to meet the needs of the region, as demonstrated by supporting technical design, hydrologic, hydraulic, and water quality analytics. This document demonstrates preliminary consideration of the technical challenges for this project as well as creative solutions that overcome these challenges by ensuring the technical feasibility of the project and positioning the design for future grant-funding with a clear demonstration of effectiveness and constructability.

1.2 EXISTING SITE CONDITIONS

Redwood City City Hall Parking Lot (1017 Middlefield Rd, Redwood City, CA 94063) is a 3.3-acre parcel owned by Redwood City. The location presently serves as the primary parking lot for the Redwood City City Hall facility and the downtown district (See Figure 1-2). During field visits, the parking lot was heavily trafficked with a majority of the parking stalls occupied including City vehicles. The parking lot has entrances on three sides with access driveways from Jefferson Ave, Main Street, and Broadway to the west, east, and north, respectively. Alternative parking locations would be needed during construction of the proposed project.

The parking lot area is flat with multiple raised paved medians that are protected by curbs. There are no noticeable retaining walls or other indications of significant slope changes within the parking lot vicinity. The pavement is in fair condition with no notable potholes or other deformities. Some intrusive vegetation is visible within the joints of the curb and pavement interface. Paid parking kiosks are found at the end of each parking aisle while light poles are scattered throughout the site.

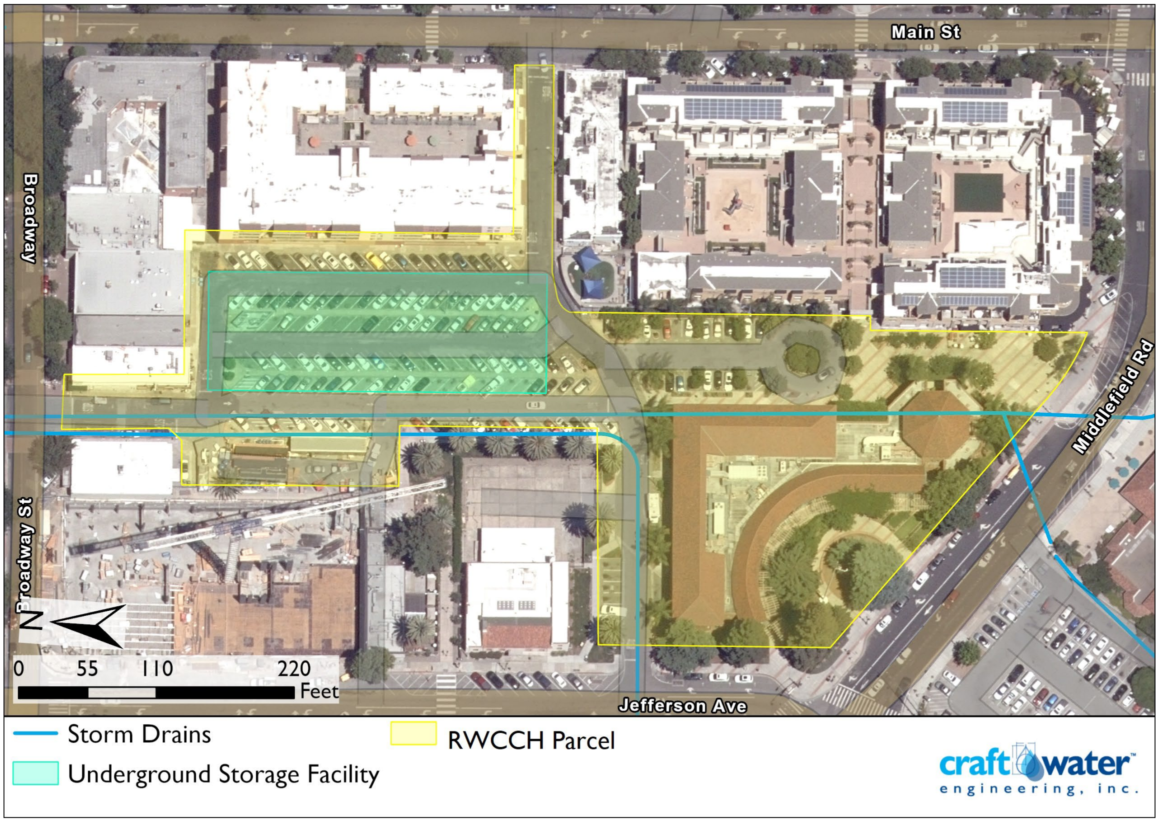


Figure 1-2. Site location and project boundary.

1.2.1 Utility Information

Various utilities were observed throughout the parking lot. There are two parallel storm drain lines that pass through the western portion of the parking lot, and the one on the east will be diverted. Large hatches were located where the storm drain line is anticipated to be. Various electrical elements (light poles and parking meter stands) are installed throughout the parking lot. The south side of the parking lot has a fire hydrant and a catch basin, which indicate the presence of other underground pipes/drains. No visible indications of sewer, gas, or fiber optic lines were observed but a full utility inquiry will determine other possible lines.

1.2.2 Geotechnical Investigation Constraints

A review of the San Mateo Plain Groundwater Basin Assessment dated July 2018, (County of San Mateo) revealed shallow groundwater depths at the project site. The shallow depth to groundwater makes this site more suitable for a subsurface storage and filtration project, rather than a subsurface infiltration gallery project. While this information is sufficient to develop preliminary design concepts, it is recommended that additional geotechnical investigation be conducted given the results of this report to further develop geotechnical design recommendations in support of final design documents.

1.2.3 Stormwater Diversion Location

The Redwood City City Hall site has the ability to target two unique storm drain lines but the drainage area to available footprint would overwhelm the facility. The more eastern storm drain line will provide a single diversion point that can be drawn from to route to the proposed facility to improve water quality. The potential location was identified (Figure 1-3) and will require careful future analysis of hydraulic capacity required to tie-in to existing infrastructure, costs related to diversion length, pumping, and retrofit of existing infrastructure, as well as agency permitting and coordination that the diversion may require. The stormwater line that will be diverted runs south to north. More information about this storm drain will be gathered during a full design evaluation.

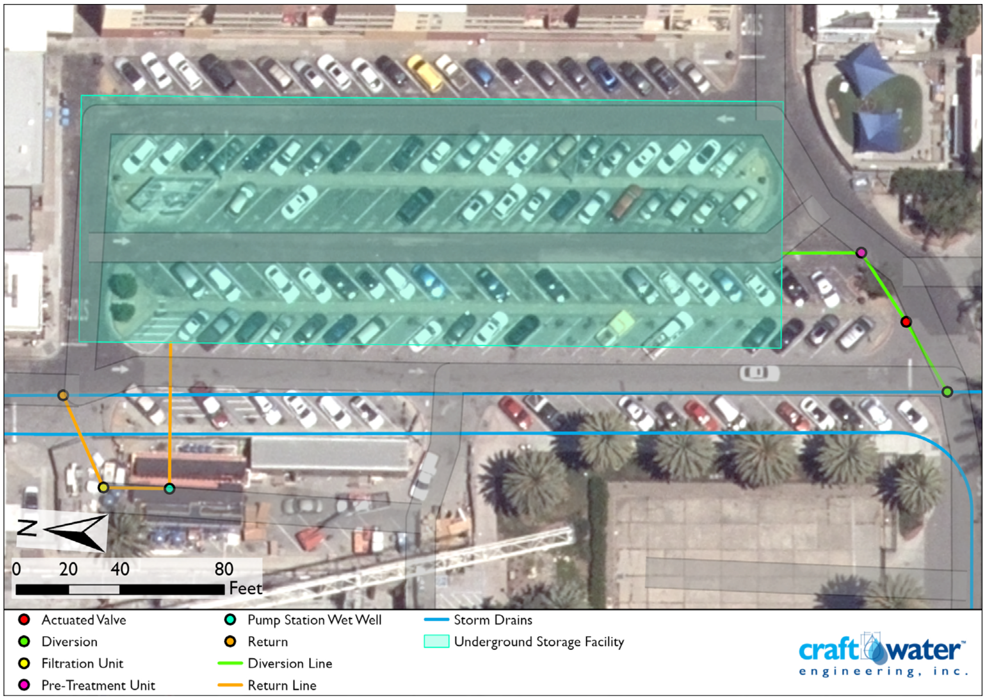


Figure 1-3. Map of diversion location.

2.0 DECISION SUPPORT MODELING

The purpose of the Redwood City City Hall project is to maximize pollutant removal and stormwater capture for beneficial reuse of captured stormwater; therefore, alternative system configurations were modeled to quantify potential performance and provide design options and considerations associated with these goals. The performance of the project as a whole is dependent on a number of configuration options as well as site constraints that determine the range of options available for the stormwater capture unit. The following sections briefly summarize the strategy to most accurately simulate these realistic engineering constraints while optimizing the system configuration to provide the most cost-effective recommendation that best meets the goals of runoff capture, water quality benefit, and water supply augmentation and reuse.

2.1 BASELINE CONDITIONS AND CONSTRAINTS

The following subsections summarize the performance targets, baseline runoff and pollutant loading, onsite non-potable water demand, and groundwater considerations used to inform modeling.

2.1.1 Stormwater Performance Targets

In accordance with the MRP sizing requirements and other countywide multi-benefit stormwater goals, the goal of capturing 80% of annual runoff over the long term has been established for regional projects. This target follows the regional goal of maximizing stormwater treatment by effectively treating the water quality design runoff volume for a project's drainage area. Long-term baseline hydrology from the Reasonable Assurance Analysis (RAA) was utilized to assess how different project options contribute to this goal at the project site. Runoff capture was also paired with water quality reductions to contextualize the multi-benefits offered by different design options for this project. By assessing different project alternatives based on long-term runoff capture and pollutant reduction, final design recommendations can be based on the performance of the BMP across a range of climate conditions to provide a more robust demonstration that the project configuration will attain comprehensive yet cost-effective performance.

2.1.2 Watershed Characterization

For this study, the Loading Simulation Program C++ (LSPC) from the RAA (C/CAG 2020) was used to simulate the sediment-bound pollutant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2006 to Water Year 2015). This model was developed and calibrated to meet criteria established by the *Bay Area Reasonable Assurance Analysis Guidance Document* (BASMAA 2017).

The drainage area delineation for the project site (see Figure 2-1) was developed using geospatial data associated with the RAA modeling subwatersheds and verified/corrected slightly using further geographic information system (GIS) analysis where full subwatersheds did not coincide with project locations. Digital storm drain inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality that was then utilized to optimize the BMP decision variables. The overall drainage area size and impervious fraction are summarized in Table 2-1.

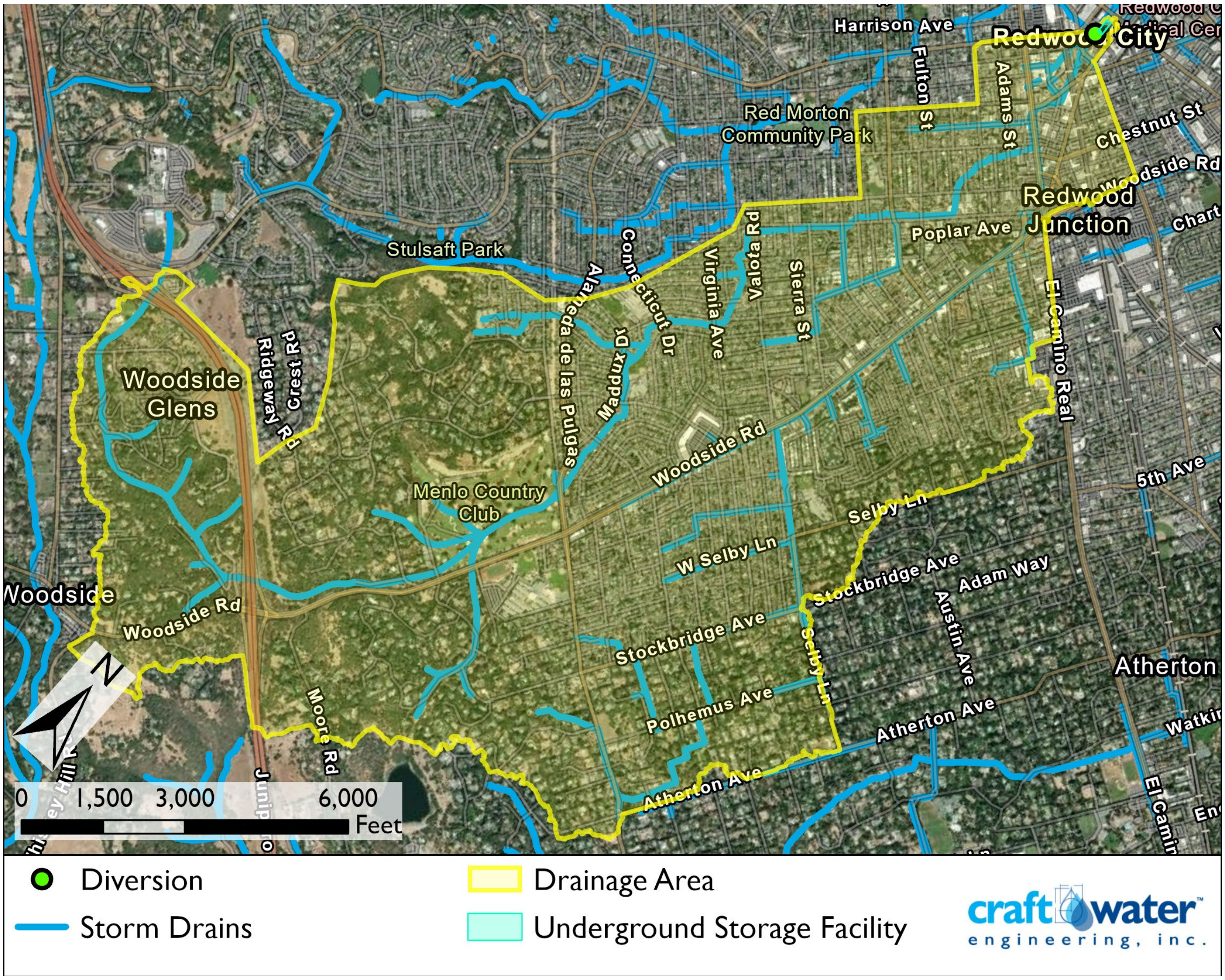


Figure 2-1. Project drainage area.

Table 2-1. Summary of modeled watershed hydrologic and water quality conditions for the Project drainage area.

Total Drainage Area (ac)	Impervious Drainage Area (ac)	Average Annual Runoff (ac-ft)	80% Avg. Annual Runoff Capture Target (ac-ft)	Average Annual TSS Loading (lbs)	Average Annual PCB Loading (g)	Average Annual Hg Loading (g)
3,371	1,471 (44%)	1,262	1,009	806,000	36.6	62.4

2.1.3 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site using the 2020 RAA model are summarized in Table 2-1. The annual loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and associated pollutant levels can potentially be diverted into the BMP. The 80% long-term runoff capture target is also identified in the table and will serve as a design consideration in sizing the BMP and making a final recommendation for this site.

2.1.4 Primary BMP Treatment/Discharge Alternatives

Multiple fates for the discharge of captured stormwater have been considered for the Redwood City City Hall Project. They are detailed here with acknowledgement of specific constraints and parameters that have been used in BMP modeling to accurately simulate the differences among the alternatives.

2.1.4.1 Infiltration

No local geotechnical investigations for the project site have been conducted, so subsurface infiltration rates are currently unknown. Local soil types indicate mostly urban soils exist at the site in HSG C. The majority of San Mateo County's soils are either in HSG C or undefined, and these soils are not typically associated with high infiltration rates. Modeling in the RAA (C/CAG 2020) utilized an infiltration rate of 0.5 in/hr for projects with similar soil types. This infiltration rate was utilized in modeling this site but will need to be verified in future design stages due to the high sensitivity of BMP performance and sizing recommendations related to this important performance variable. A more conservative infiltration rate of 0.2 in/hr was also modeled which represents average rates for HSG C soils identified by a large review of national studies (MSSC 2005) and documents relating this property to the HSG.

2.1.4.2 On-site non-potable use

Capture, storage, and filtration of stormwater is increasingly utilized for on-site non-potable use as stormwater offers an attractive supplemental water source where water demands can be met by dry-weather flows. Coordination with the City can identify other non-contact uses including municipal tree watering, street sweeping, or other on-site non-contact uses through City operations This option will require a treatment system that filters and sanitizes stormwater so that it is safe for irrigation and able to meet or exceed National Sanitation Foundation NSF-350 standards for non-potable water, as well as any local water quality standards. An assessment of expected monthly irrigation demand and average monthly dry-weather flows will provide further information whether this practice would be warranted at this site.

2.1.4.3 Filtration / Return to Storm Drain

As an alternative to infiltration, the Redwood City City Hall Project site could be designed to capture stormwater and filter it, using a proprietary stormwater filtration unit before returning captured flows to existing storm drains. This option typically offers an alternative discharge in areas where infiltration is infeasible or limited in throughput. Filtration offers high efficiency in water quality treatment for regional projects that can treat a large drainage area in a cost-effective manner despite infiltration rates that may not be favorable to support that type of BMP in a given location or area. Based on current regulatory interpretations in the area, filtration of captured stormwater and return to storm drains using proprietary devices is not currently acceptable practice to receive full credit for treatment via regional BMPs. This option was still considered, and performance results will be shared herein in case infiltration is deemed infeasible at the site and an alternative treatment is necessary in the future. Additionally, this site was not identified as a High Potential Stormwater Recharge area in the characterization of the San Mateo Plain Groundwater Basin (SMC 2018) so recharge at this location may not be favorable, making filtration an important consideration in maximizing pollutant removal for the project's drainage area.

2.1.4.4 Sanitary Sewer/Waste Water Treatment Plant Discharge

The final possible discharge alternative is the release of captured stormwater to the sanitary sewer system. The sanitary sewer system has pipes located throughout the downtown district that convey flows to the treatment plant. An evaluation of the capacity of the lines would identify the opportunity to discharge into the system. White this alternative was not explored through the course of this concept design as it requires modeling coordination with the sewer authority to determine capacity and discharge windows, this option should be further explored during the pre-design phase of the project. The sanitary sewer diversions have been shown to be desirable for the region as it qualities for associated pollutant reduction and possible beneficial use.

2.2 WATER QUALITY OPTIMIZATION STRATEGY

The primary design goal of the Redwood City City Hall Project is to capture runoff and reduce long-term annual loading of pollutants to the watershed and downstream receiving waters. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see Figure 2-2 at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

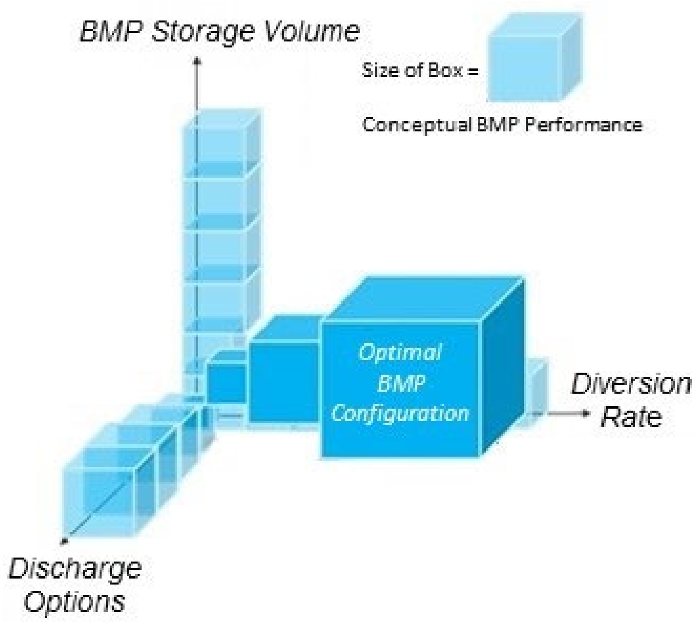


Figure 2-2. Conceptual graphic representing BMP configuration optimization.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. In this approach, sediment pollutant loading capture is a useful surrogate for overall water quality cost-optimization as significant pollutants of concern (metals, PCBs, nutrients) are typically sediment bound. The general methodology is discussed below, and the results are presented thereafter.

2.2.1 Preliminary Size and Diversion Optimization

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. A custom BMP model was used to improve upon certain modeling limitations in EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN). This custom model is grounded in the physical BMP representations used in SUSTAIN, and it provides built-in optimization algorithms to more systematically automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by LSPC at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

2.3 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term runoff capture and pollutant load reduction by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective alternative. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters arepresented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will provide the most cost-effective range of benefits in line with regional stormwater management goals.

2.3.1 Diversion Rate

Multiple diversion rates were modeled for this project from 10 to 60 cfs by 10 cfs increments. The design diversion rate should be selected with care. The diversion rate should be large enough to direct a substantial amount of the expected runoff into the BMP, especially runoff during the first flush of storm events which often carries a large amount of the pollutant load for a given watershed. It should also not be sized too large that it is out of balance with BMP storage and outflows causing the BMP to fill too fast during wet weather and limit overall BMP capture or require oversized infrastructure given the runoff dynamics in the watershed. Plots of diversion rate versus runoff capture for the proposed BMP show that stormwater captured would increase with diversion rate substantially until the diversion rate reaches 30 cfs (see Figure 2-3). For higher diversion rates, only modest improvements in captured stormwater would be expected. Because of this, a maximum diversion rate of 30 cfs is recommended for this project.

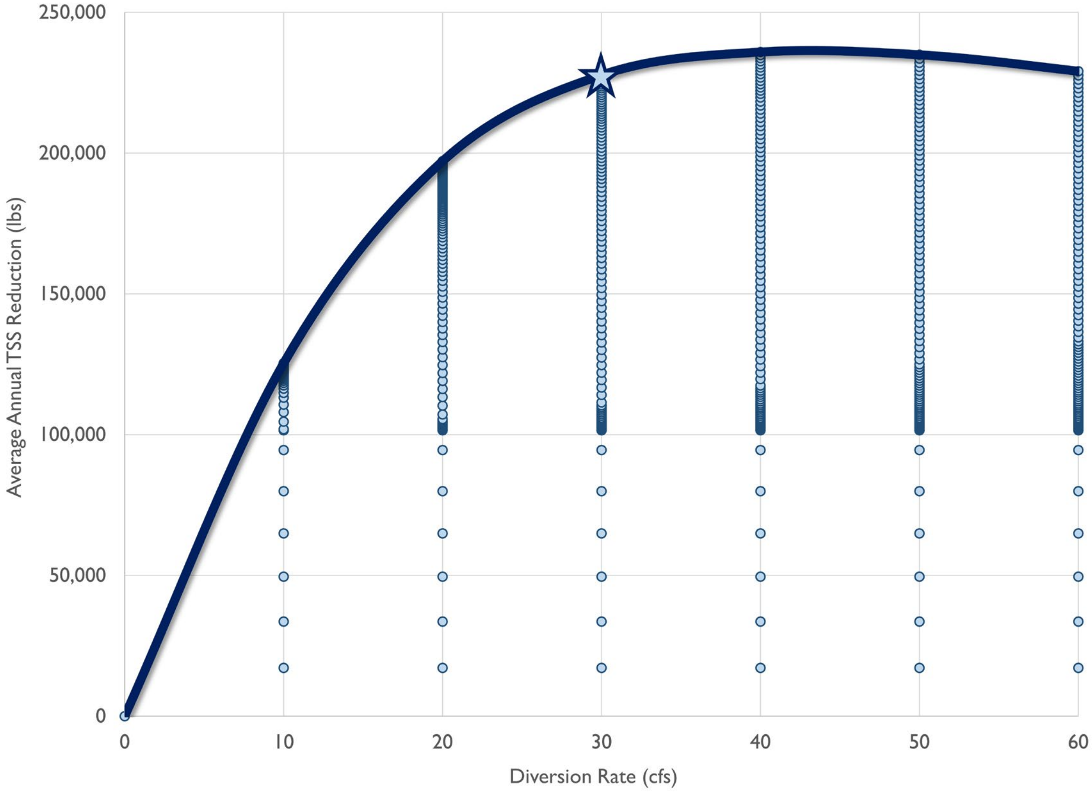


Figure 2-3. Average annual TSS reduction associated with variable diversion rates.

2.3.2 Sizing for Runoff Capture Volume Targets

The ultimate water quality goal for the Redwood City City Hall Project would be to size the BMP so that it is able to capture 80% or more of the long-term average annual runoff. The BMP was modeled across different diversion rates and storage sizes up to just greater than 10.0 ac-ft to assess the relationship between BMP sizes and runoff capture. Figure 2-4 shows how runoff capture varies with storage volume for a BMP with a 30 cfs diversion rate at this site for filtration (at standard 7.84 cfs) and infiltration (0.5 & 0.2 in/hr) configurations. Even at 10.0 ac-ft of storage, the BMP is not able to meet this runoff reduction target for the probable range of infiltration/filtration rates at this site. While the 80% runoff capture target might be impractical or infeasible to accomplish for this site, a regional BMP at the Redwood City City Hall would still offer substantial runoff capture and water quality benefit for the drainage area.

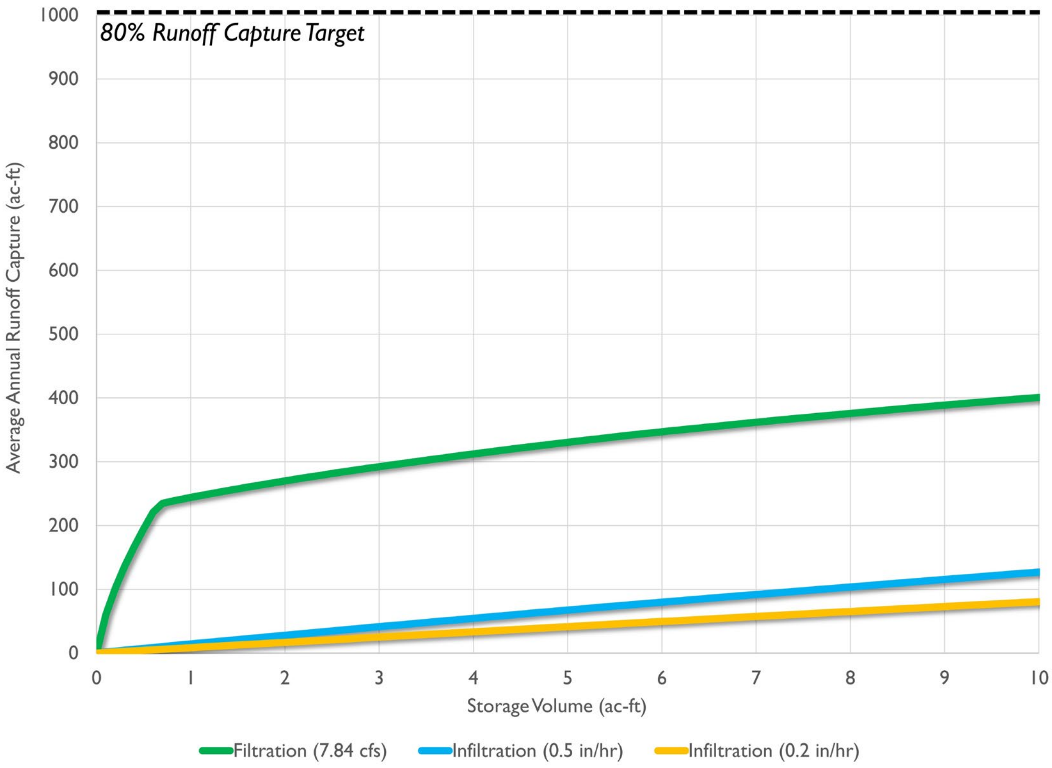


Figure 2-4. Runoff capture as a function of storage volume for the project with a diverion rate of 30 cfs.

2.3.3 Sizing for Water Quality Benefits

Often regional BMPs have very large drainage areas and only a modest portion of annual runoff can be captured. If sized correctly, these practices can still be very impactful in terms of pollutant reductions. Assessing the modeling results across BMP storage volumes for a BMP with a 30 cfs diversion rate, it is evident that this is the case at the Redwood City City Hall (Figure 2-5). It can be seen by the shape of these curves that runoff capture and pollutant reduction do not occur in sync and that these dynamics are related to storage volume in a somewhat different manner due to the different dynamics in the watershed related to rainfall-runoff responses and pollutant generation. In lieu of meeting runoff capture targets, it is useful to size a BMP to maximize water quality benefits as a secondary criterion at a storage volume along these curves before they show diminishing returns (ie, only slight increases in water quality benefit for increased storage volumes). This sizing will be revisited in the following section to highlight multiple potential BMP endpoints for this site.

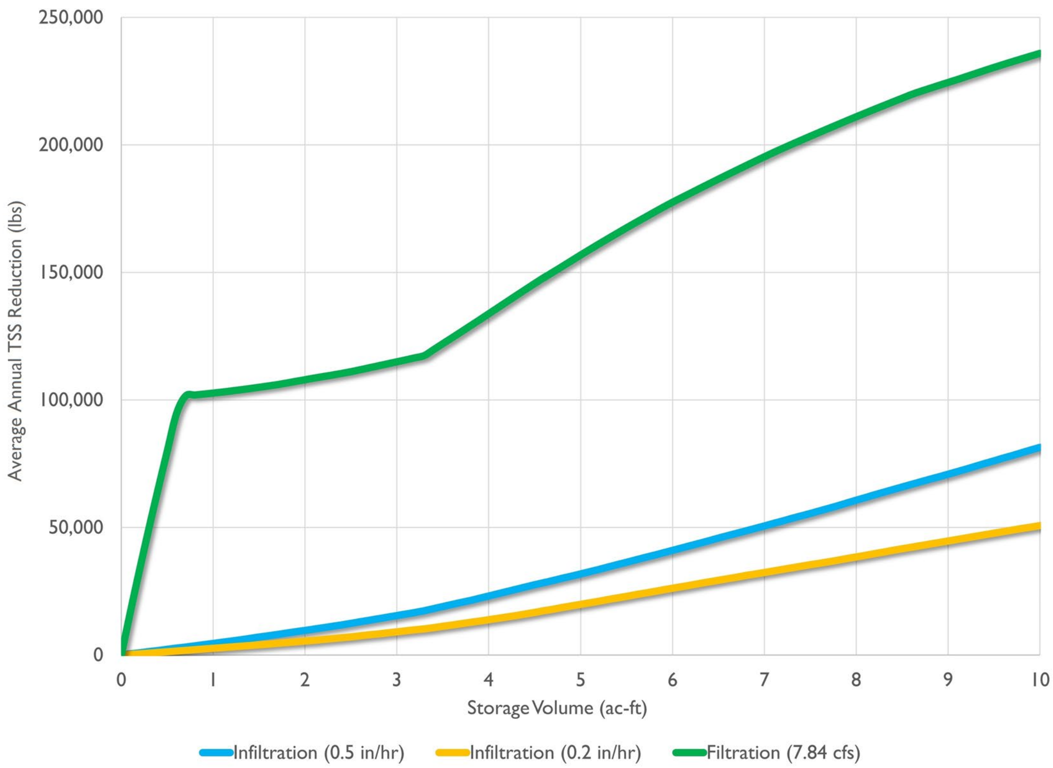


Figure 2-5. Water quality benefit as a function of storage volume for the project.

2.3.4 Considering On-site Irrigation/Toilet Flushing Reuse

The use of captured stormwater for irrigation use and toilet flushing was not explicitly modeled. This is because this reuse option would accompany infiltration options as an ancillary benefit and would not have a significant impact on overall annual water quality benefit estimates. Dry-weather flows are typically tapped as a resource for irrigation reuse because the volume is more manageable, reliable, and appropriate for use as an irrigation water source. Irrigation does not typically occur during wet-weather events, and the large runoff volumes collected during these events would not likely be used on-site within recommended storage volume drawdown time periods (72 hours). There is typically adequate available storage in the BMP during dry conditions to capture all dry-weather flows and either filter them for irrigation use or allow them to discharge normally. To better understand on-site irrigation demands, monthly estimates for the Redwood City City Hall were calculated based on average monthly evapotranspiration data (CIMIS 2019) using the SLIDE rule (Simplified Landscape Irrigation Demand Estimation; ANSI 2017). It was assumed that, if chosen as an option, stormwater would supply the approximately 0.5 acres of on-site shrubs at the Redwood City City Hall in addition to some of the nearby bathroom facilities. These results are displayed in Figure 2-6, and they indicate that average monthly irrigation demand approaches or exceeds dry-weather runoff for some of the growing season. For these purposes, dry-weather runoff here has been defined as modeled runoff on days when rainfall is less than 0.1 inches. The exception is during the cooler, wetter winter months when irrigation supply is in less demand. While dry-weather flows should always be verified through monitoring, the size of the drainage area is not likely to support enough flow to meet irrigation demands at the site and would be of limited potential for area reuse.

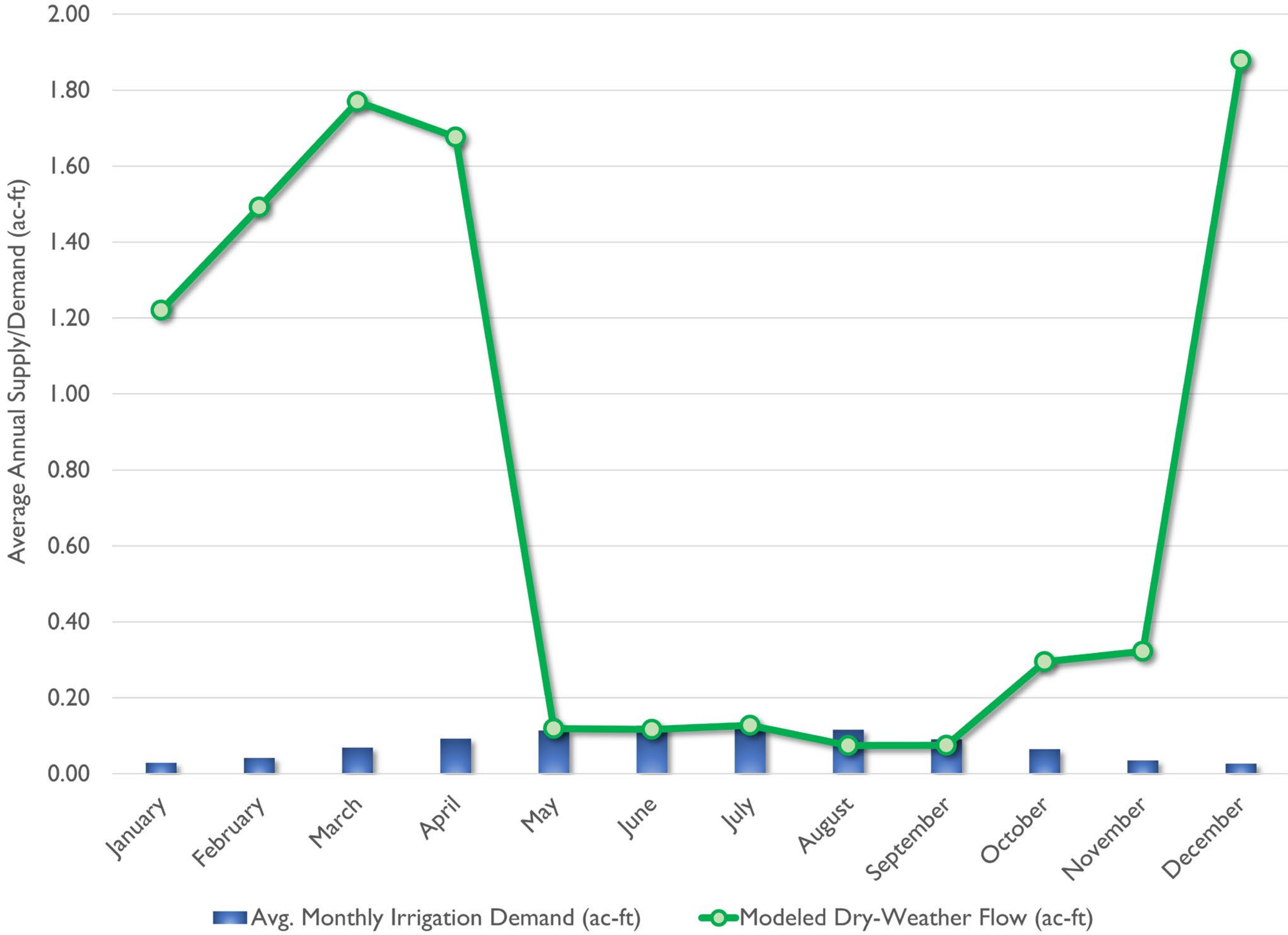


Figure 2-6. Estimated irrigation water demand and potential dry weather supply for the project.

2.3.5 Cost Considerations and Project Sizing

To make final recommendations, water quality benefits predicted for the different BMP configuration options should be weighed against expected capital construction and operations and maintenance costs (O&M; 20 years included) to determine the optimal choice for the Redwood City City Hall Project. Table 2-2 details key aspects of cost to consider for different project options that are both consistent among and differentiate the various modeled options.

Table 2-2. Summary of key cost components for different discharge options.

Cost applicable to….	Key Cost Components	O&M Cost Components
All Options	Diversion Infrastructure, Pretreatment	Inspection, Sediment Removal
Infiltration Vault	Concrete Vault Structure, Optional Pump to Vault	Pumping Maintenance/Electricity
Irrigation Reuse	Filtration Unit, Irrigation System	Filter Operation, Cleaning/Replacement
Filtration/Detention	Excavation, Filtration Unit(s)	Filter Cartridge Cleaning

2.3.5.1 Project Sizing

Because the overall goal for a project at this site is pollutant reduction, plotting storage volume (the bulk of the project's cost) against average annual sediment reduction from model results is useful to help size a project (Figure 2-7). It is often advisable to build out a project to one of two endpoints: (1) the cost-effective size at which BMP performance exhibits diminishing returns in terms of project objectives or (2) the maximum feasible size for the project site. Based on the curves for water quality benefit at this site, points of diminishing returns are close to or beyond the maximum feasible project size for the site (approximately 5.4 ac-ft based on design engineer review of the project site). Project details for a BMP utilizing a 30 cfs diversion at this maximum storage volume (5.4 ac-ft) are summarized in Table 2-3.

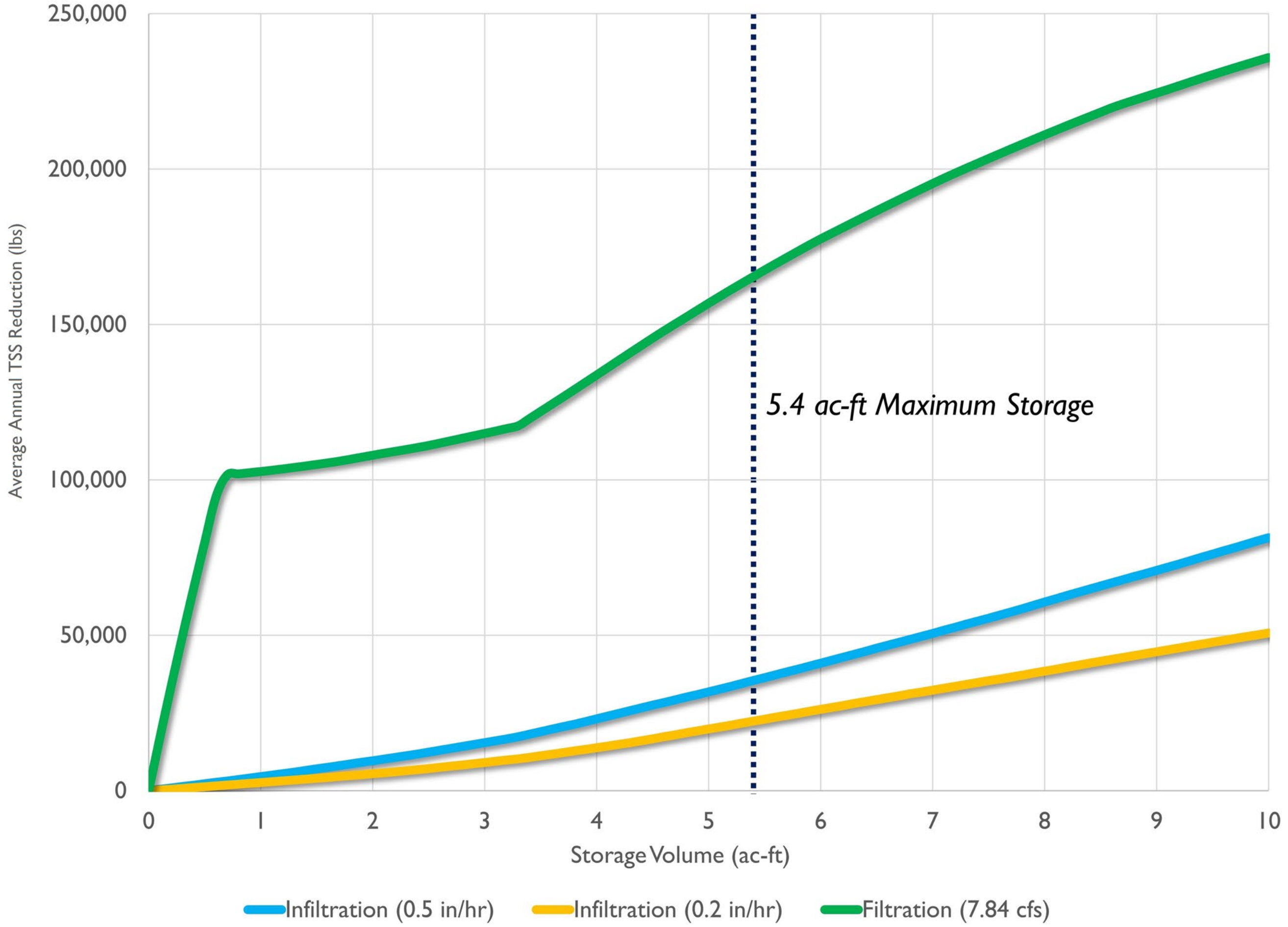


Figure 2-7. Project storage volume vs pollutant reduction for a BMP with a 30 cfs diversion rate at the site.

2.3.5.2 BMP Size Options

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized using different discharge options.

Capture of 80% of Long-Term Annual Runoff

Feasible capture of 80% of average annual runoff is not possible across modeled BMP storage volumes with the diversion rate of 30 cfs that was identified. BMP volumes up to 10.0 ac-ft were modeled based to fully assess the relationship between storage and performance at the project site. However, for even the highest diversion rate and storage volume combinations modeled, a BMP at this site is not expected to be able to attain an 80% annual runoff reduction given expected filtration/infiltration rates. Considering a maximum feasible size of 5.4 ac-ft that accounts for infrastructure configuration and setbacks needed at the site, meeting this target would not likely be practical or feasible at this site using an infiltration BMP.

Most Cost-Effective Pollutant Reduction

Because capture of 80% of the long-term annual runoff at this site would be difficult and cost-prohibitive, a more cost-effective sizing approach would be to right-size the BMP to maximize water quality benefits up to a BMP size of diminishing returns. Since this would be near or beyond the maximum feasible storage size for the site, a BMP with the maximum of 5.4 ac-ft of storage is recommended. The expected benefits for this BMP size for different discharge options have been summarized in Table 2-3. These are also displayed in Figure 2-7.

Table 2-3. Summary of cost-effective BMP sizing for each discharge option

Treatment Rate	Avg. Annual Runoff Capture (%)	Avg. Annual TSS Reduction (%)
Filtration @ 7.84 cfs	27%	21%
Infiltration @ 0.5 in/hr	6%	4%
Infiltration @ 0.2 in/hr	4%	3%

Most cost-effective BMP size for the Redwood City City Hall site

Based on the results for runoff capture and pollutant reduction, it is recommended that the Redwood City City Hall Project be sized with a 30 cfs diversion rate and 5.4 ac-ft storage. Additionally, because pollutant capture is the primary objective for this project, filtration as the treatment mechanism is highly preferable due to the efficiency of treatment and the uncertainty related to infiltration rates. This recommendation can be revisited once site infiltration rates are known to ensure that this option and the corresponding sizing is still the most cost-effective option for this project. It should be noted that acceptance of the filtration devices is being discussed by the Regional Board regarding the MRP compliance needs versus the recognized BMPs/configurations for LID. No resolution has been reached to date but ongoing discussions are being had to evaluate filtration as a viable alternative.

3.0 BMP DESIGN COMPONENTS

This section presents the engineering and design components recommended for Redwood City City Hall based on the preceding decision support modeling to capture both dry weather and wet weather flows from the drainage network.

3.1 DIVERSION STRUCTURE

A single point of diversion is proposed as a part of the recommended project. A manhole junction structure is proposed along the existing storm drain to divert stormwater during low-flow and up to 30 cfs during storm events to the pretreatment device. At the proposed flow rate of 30 cfs, the structure will require a 2.6-foot drop below the existing invert and a 30-inch diameter diversion pipe at a 0.5% slope. Figure 2-1 shows an example schematic of the proposed storm drain diversion manhole structure.

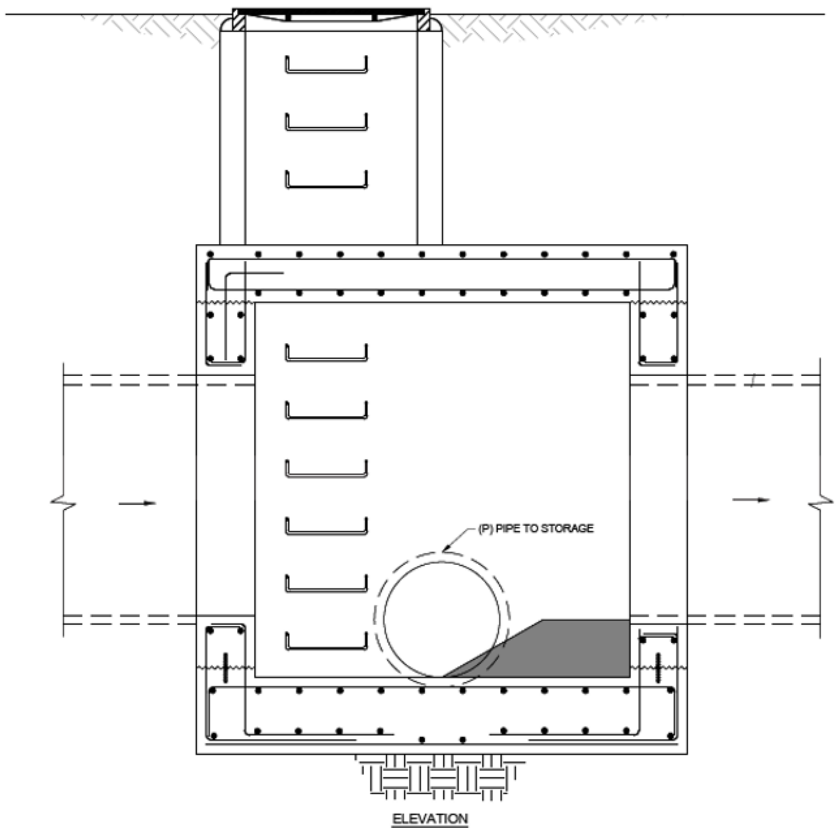


Figure 3-1. Schematic of diversion in storm drain.

3.2 PRETREATMENT

Stormwater runoff transports sediment, metals, nutrients, trash, and debris that can compromise the performance of stormwater facilities and pollute receiving waters. Pretreatment will be an integral component of the treatment strategies to extend the life of the system. It will be prescribed in order to reduce the maintenance frequency of the City Hall stormwater facilities, focus maintenance efforts to a concentrated area, and bolster compliance. Two of the pretreatment devices evaluated for this project are included in the following sections. Other similar units are also readily available and can be evaluated and selected during the later design phase of this project.

3.2.1 Hydrodynamic Separators

A typical hydrodynamic separator collects the stormwater runoff on one or more sides of the structure where it then directs the water into a separation chamber where water begins swirling, forcing the particles out of the runoff. All floatables and neutrally buoyant debris larger than the screen aperture (2400 microns or 2.4 mm) are collected in the isolated sump of the system, eliminating scour potential. In addition to the screen aperture filtration, at least 80% of particles that are 130 microns or larger in size are removed for flows up to 30 cfs. With the chambered system, hydrocarbons float to the top of the water surface and are prevented from being transported downstream. Systems such as the Contech CDS units are designed with a hydrocarbon baffle to contain hydrocarbons within the device. A target flow rate for each of the devices will be based on the final design of the diversion structure. Currently a total of 30 cfs from the RCP diversion is anticipated to be diverted to a single pretreatment device. It will be designed to have the capacity to treat the maximum flow diverted to the unit. The size of the unit will also be based on the estimated sediment that will be collected in the sump to maximize sediment removal while balancing the routine maintenance required. Figure 3-2 represents a typical Contech CDS type hydrodynamic separator. The Stormceptor and the Jensen Deflective Separator are other examples of hydrodynamic separators.

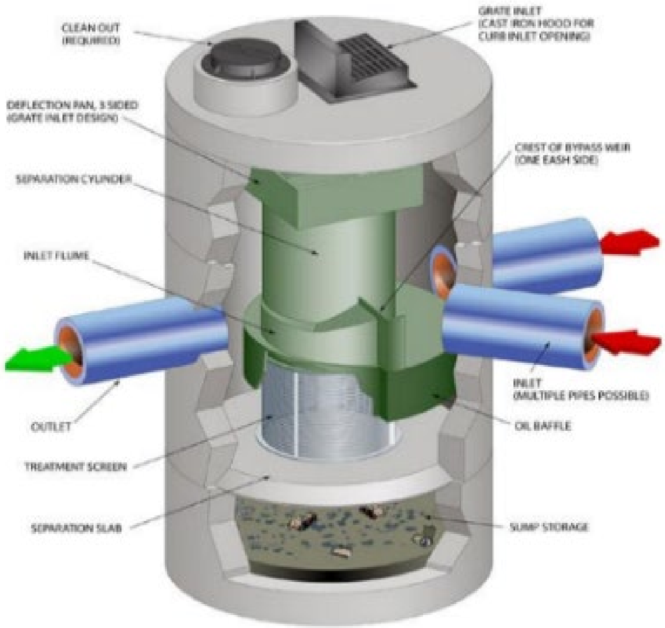


Figure 3-2. Typical Hydrodynamic Separator (Source: Contech Engineered Solutions)

3.2.2 Debris Separating Baffle Box

Debris Separating Baffle Boxes (DSBB) by Bio Clean Environmental Services and the Nutrient Separating Baffle Box (NSBB) are also being considered as pretreatment solutions for the Redwood City City Hall regional project pipe diversion. At a total flow rate of up to 30 cfs, DSBBs are available in models varying in the level of treatment they can be provide (i.e., 150 microns vs. 250 microns). The DSBB systems use screens that are suspended above the sedimentation chambers that capture and store trash and debris. TSS is removed by routing the flows through a triple chambered system. An oil skimmer with hydrocarbon booms traps and absorbs oil. Figure 3-3 illustrates the typical operation of a DSBB system.

A summary comparison of the five pretreatment devices is provided in Table 3-1.

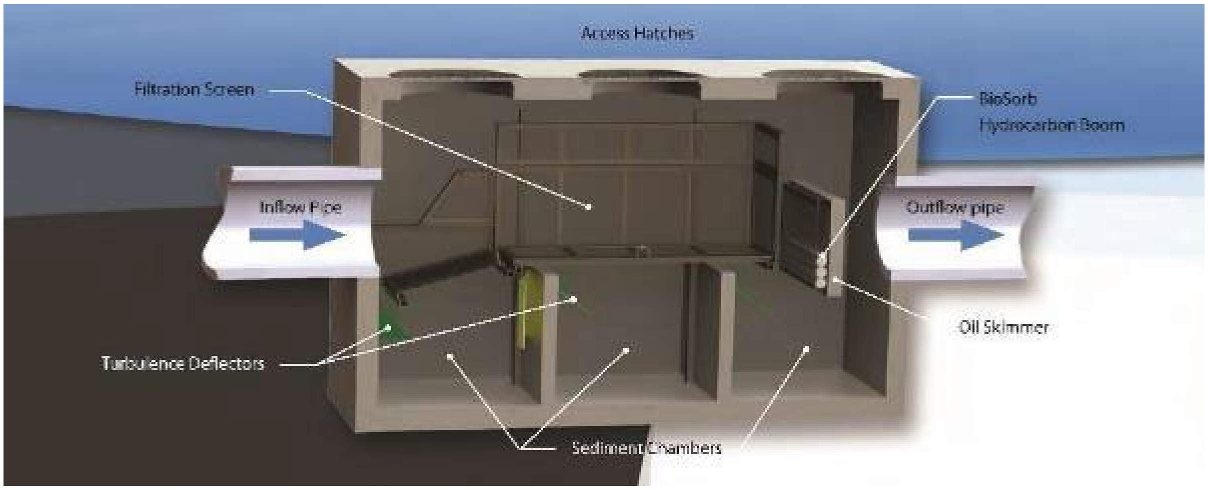


Figure 3-3. Typical DSBB System (Source: Bio Clean Environmental, Inc.)

Table 3-1. Comparison of Pretreatment Devices

	Contech CDS	Jensen Deflective Separator	Stormceptor	Bio Clean DSBB	Suntree Technologies NSBB
100% Gross Solids Removal (Full Capture Device)	Yes	Yes	No	No	No
Internal Bypass	Yes	Yes	Yes	Yes	Yes
Maximum Prefabricated Sediment Storage Sump Capacity	8.7 cy*	37.2 cy	> 70 cy	31.7 cy	> 30 cy
Effective up to 30 cfs	Yes	Yes	Yes	Yes	Yes

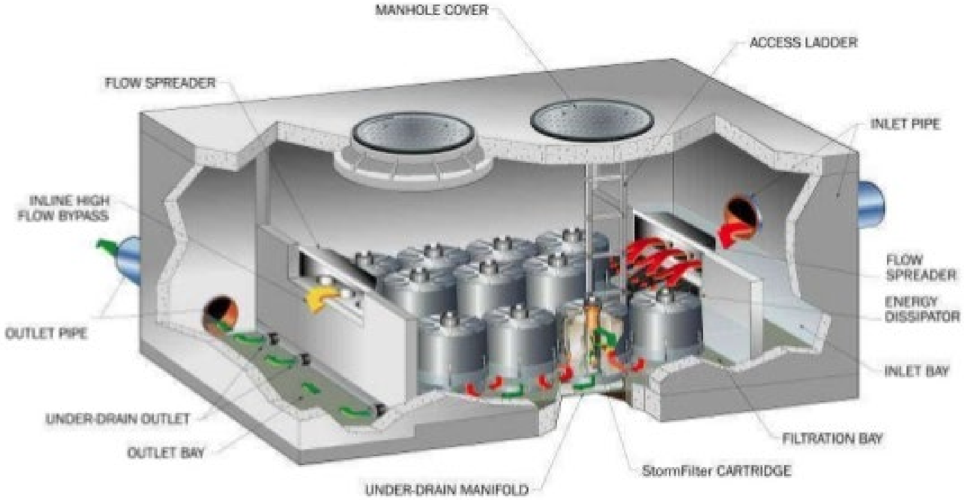
* Contech CDS can be constructed deeper to accommodate greater sediment storage if needed

3.3 DISCHARGE TREATMENT PUMP AND FILTER

The pump and filter system provides final pollutant removal prior to discharge back into the storm drain. The pump lifts the water from the storage tank invert back to an elevation that matches the existing storm drains while the filter unit polishes the runoff prior to discharge into the existing storm drain system. There are various filtration options including cartridge filters and up-flow media filters.

3.3.1 Cartridge Filters

The most commonly used filtration system is cartridge system (Figure 3-4). Flow enters the filter where it is then provided sufficient contact time with the filter cartridges. The cartridges has an opening size of 10 microns and typically can treat anywhere from 0.05 gallons per minute (gpm) to 1 gpm per square foot of cartridge surface area. Multiple cartridges are installed in a large concrete reservoir that can be sized according to the designed discharge rate. Pollutants build up on the cartridge preventing migration back to the storm drain. The cartridges can be cleaned and re-used providing an easy maintenance process. The Contech StormFilter and BioClean Kraken are examples of cartridge filters used for stormwater treatment.



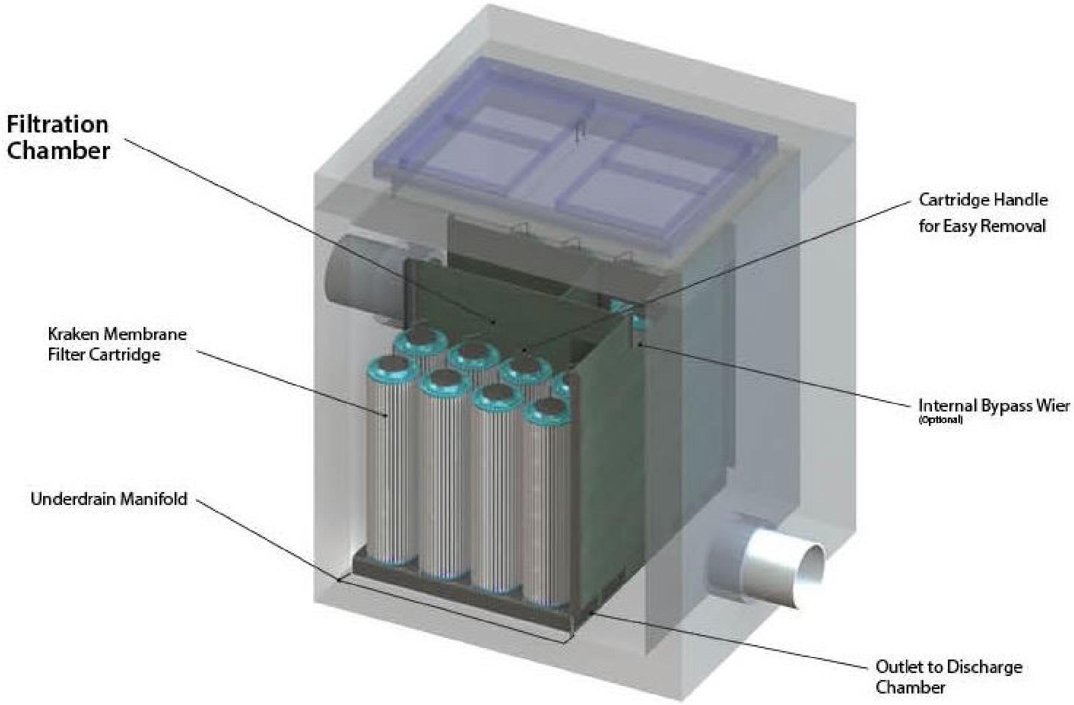


Figure 3-4**.** Example cartridge filter systems

3.3.2 Up-flow Media Filters

Up-flow media filters are designed to force water to flow up through a media bed trapping pollutant on the underside allowing them to fall to the bottom of the unit for removal (Figure 3-5). Flow enters the unit and builds pressure through a series of chambers and then passes through the media. Once the flow subsides, the water level will be lower, causing the pressure to drop, reversing flow through the filter and removing the pollutant. This allows for passive back wash that will prolong the life of the filter through the prevention of clogging. The BioClean Water Polisher is an example of an up-flow media filter. Flowrates for this up-flow filter can reach up to 1.64 cfs depending on the size of the unit.

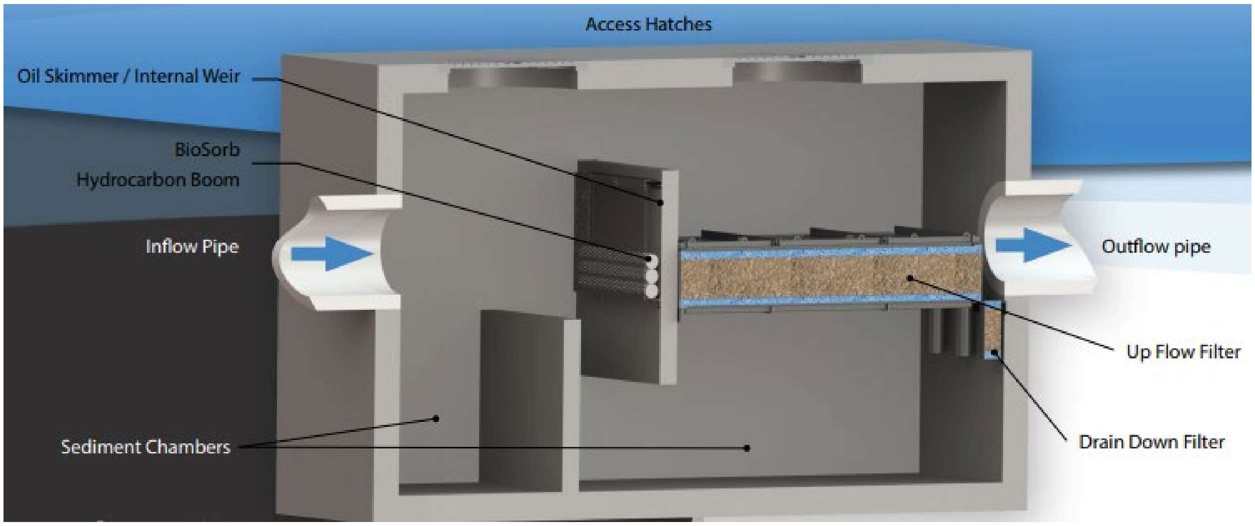


Figure 3-5. Example up-flow media filter system

3.4 PROPOSED STORMWATER BMP

A 5.4 ac-ft subsurface storage facility is proposed at the parking lot location (see Figure 3-6 and Figure 3-7). Water quality treatment in the system is accomplished through pretreatment and filtration.

Diverted flows up to 30 cfs will be pretreated before conveyance to the tank. The diversion line is controlled by an actuated valve to protect the system during high flows and allow for maintenance. A ponding depth of 10.0 feet and a freeboard of 1.0 foot will be maintained within the system for captured stormwater. Water will be pumped out of the tank and treated by a filtration unit before being discharged to the same storm drain. To maximize storage volume and allow for maintenance, the storage tank will occupy the entire parking lot on the east side of the storm drains, whereas the pump station and the filter unit will be placed on the west side of the storm drains. The runoff from the parking lot surface will be directed to the subsurface facility for treatment.

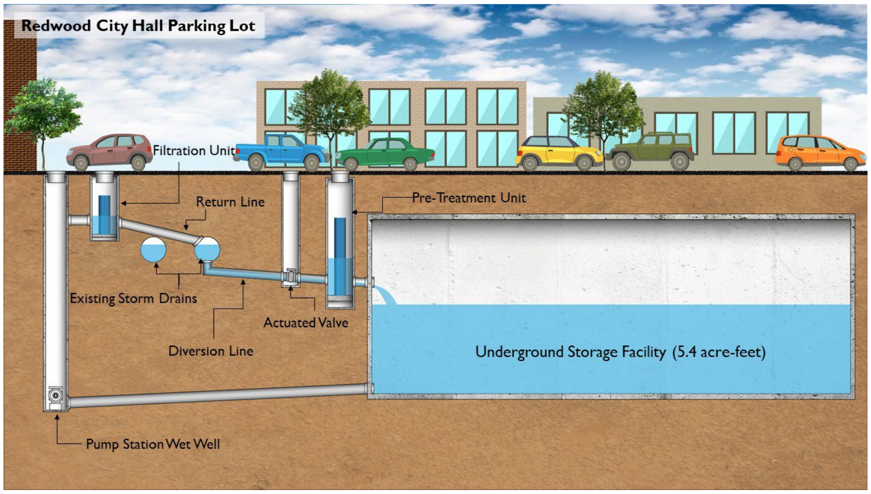


Figure 3-6. Redwood City City Hall BMP Preliminary Concept Profile

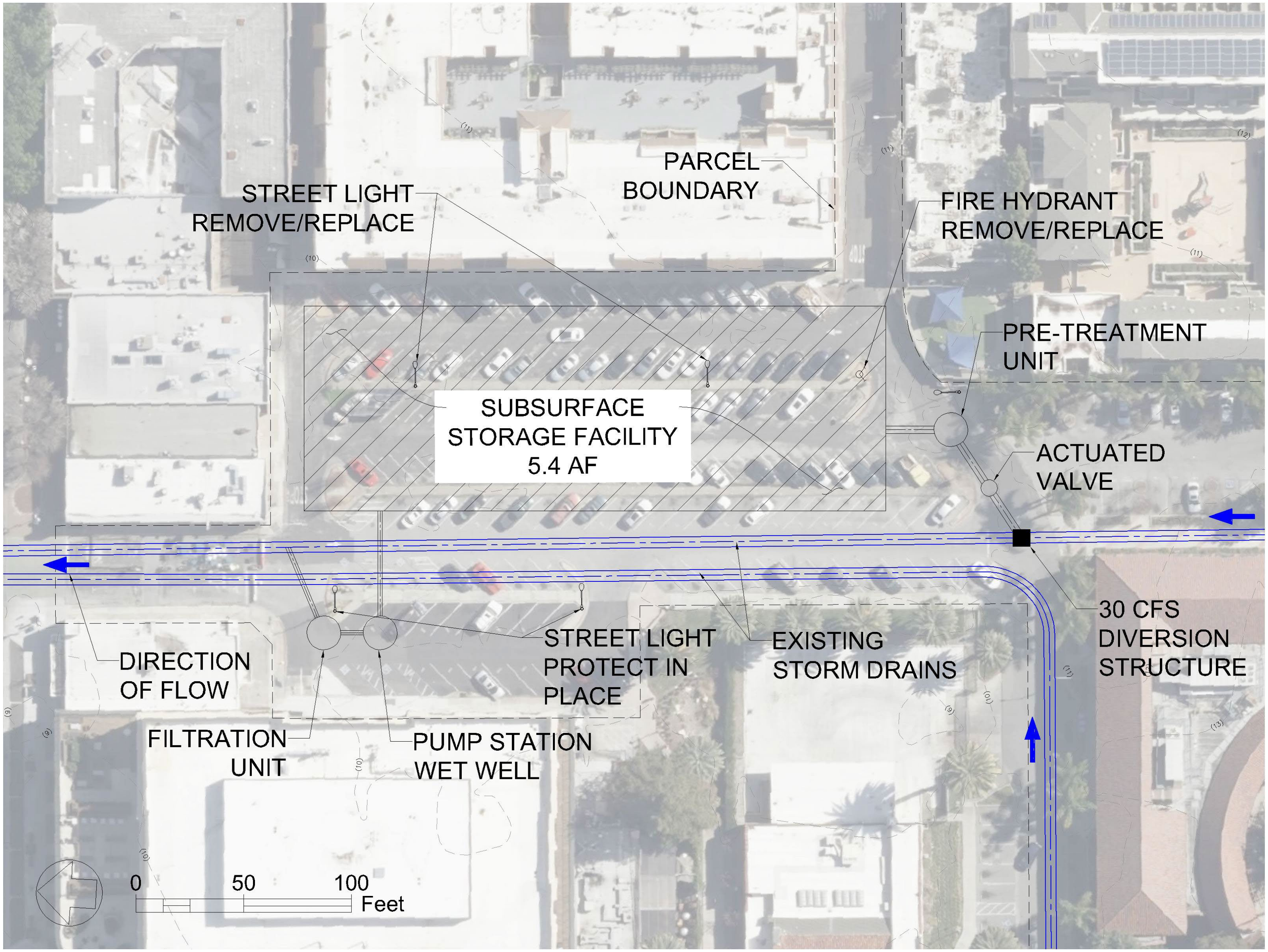


Figure 3-7. Redwood City City Hall BMP Layout

4.0 ANTICIPATED PERMITS AND COORDINATION

Consultation with regulatory agencies and acquisition of permits is required before the project components can be constructed. The following table summarizes the plan checks, regulatory permits, and approvals relevant to the project (Table 4-1). Additionally, a full Phase I environmental study should be performed at the site.

Table 4-1: Listing of Anticipated Required Permits.

Agency	Permit/Notification Name	Rationale	Initial Steps
State Water Resources Control Board	CWA Section 401, Water Quality Certification	Potential discharge of dredged or fill material to waters of the State	File a permit with the Regional Board
CA Natural Resources Agency	CEQA Initial Study	State mandated environmental review	Prepare the Initial Study and associated documentation (Mitigated Negative Declaration [MND] or Environmental Impact Report [EIR])
Bay Area Air Quality Management District	Regulation 6, Rule 1	Prevent, reduce, or mitigate fugitive dust emissions from construction activities.	Construction in the Bay Area Air Basin must incorporate best available control measures in conformance with Regulation 6, Rule 1
San Mateo County Public Works	Erosion and Sediment Control Plan	Project will require grading and site disturbance	Preparation of the erosion control plan in conjunction with the SWPPP development
San Mateo County Mosquito & Vector Control District	Mosquito & Vector Abatement District	Potential mosquito concerns.	Provide Vector Control District conceptual project plans for review.
Regional Water Quality Control Board	Bay Area MRP, C.3 Regulated Project	Project is expected to replace more than 5,000 s.f. of impervious surface.	Complete C.3 Regulated Project Checklist and stormwater control plan for the City's Community Development Department
City of Redwood City Community Development Department	Encroachment Permit	Construction work in, on, under, or over the surface of City’s right-of-way	File a permit with the City’s Community Development Department
AB52 Tribal Resources Consultation	Consultation with Native American representatives	Required per AB 52	Identify tribes that have asked to be notified by the County and prepare letters for submission to the surrounding indigenous tribes

5.0 COST ESTIMATE AND SCHEDULE

The cost estimate and project schedule have been created to validate that the project concept may be built within the specified budget and within the time allocated to use the funds.

5.1 PROJECT COST ANALYSIS

The cost analysis is utilized as a tool to ensure the project concept is within the amount of funds available to the project. If the cost analysis indicates that the project is not feasible, then the design will need to be adjusted to bring it within the project budget while still meeting the project goals. The cost analysis was developed using various sources of information, as well as the Cost Estimator's judgment.

5.1.1 Construction Costs

The construction cost entails the various components of the project that a Contractor would construct. Construction costs do not include items of work not directly performed by the Contractor, such as the County's construction management during construction. The construction costs were developed using various sources of cost information. The estimated total construction cost is $7,831,822 for the recommended BMP configuration. Table 5-1 lists the respective breakdowns of the items required to complete the project. A more detailed cost estimate can be found in Appendix B.

Table 5-1. Estimated Construction Costs, Optimal BMP Configuration.

PLANNING LEVEL COST ESTIMATE				
Description	Quantity	Unit	Unit Price	Total
Diversion Structure	1	EA	$95,000	$95,000
Pretreatment	1	EA	$90,000	$90,000
Diversion Pipe (30" RCP)	86	FT	$408.34	$35,118
Excavation & Site Demo	18,912	CY	$41.45	$783,951
Subsurface Storage Reservoir	260,663	CF	$13.28	$3,462,073
Outflow Pump, Filter, & Pipe	1	EA	$762,454	$762,454
Surface Restoration	28,440	SF	$14.63	$415,960
CAPITAL SUBTOTAL				$5,644,555
Mobilization (10% capital)				$564,456
Contingency (15% capital)				$846,684
Design (10% of Capital, Mobilization, and Contingency)				$705,570
Environmental Documentation & Permitting (1%)				$70,557
CONSTRUCTION TOTAL				$7,831,822
Assumptions: -Full itemized cost estimate included in Appendix B -Rough order of magnitude preliminary opinion of costs. Actual costs may vary -Soils are not conducive to infiltration and a pump/outflow filter will be required -Shoring is required for construction due to space limitations				

5.1.2 Operations & Maintenance Costs

Long-term maintenance of the system is vital to its operation. The operations and maintenance costs were developed on the basis that a service contractor would maintain the various components of the system. Estimated total annual operations and maintenance costs are presented in Table 5-2.

Table 5-2. Annual Estimated Operations & Maintenance Costs.

PLANNING LEVEL OPERATIONS & MAINTENANCE ESTIMATE				
Description	**Frequency**	**# Times per Year**	**Unit Price**	**Total**
Diversion Structure - Inspection and Cleaning	Monthly	12	$8,000	$96,000
Pretreatment Device - Vacuum	Quarterly	4	$10,000	$40,000
Post-Treatment Filter Device - Vacuum	Quarterly	4	$10,000	$40,000
Wet Well - Wet Season Inspection & Cleaning (Vacuum)	As-Needed	6	$10,000	$60,000
Valve Maintenance	Semi-Annually	2	$5,000	$10,000
Control Panel Inspection and Maintenance	Annually	1	$4,000	$4,000
Storage - Wet Season Inspection and Cleaning (Vacuum)	Quarterly	4	$10,000	$40,000
Filter - Inspection & Cleaning	Annually	1	$20,000	$20,000
TOTAL (Annual)				$310,000

5.2 IMPLEMENTATION SCHEDULE

The preliminary project implementation schedule is provided in Figure 5-1. The schedule includes finalizing the design plans, environmental planning and permitting, bid and award, and construction.

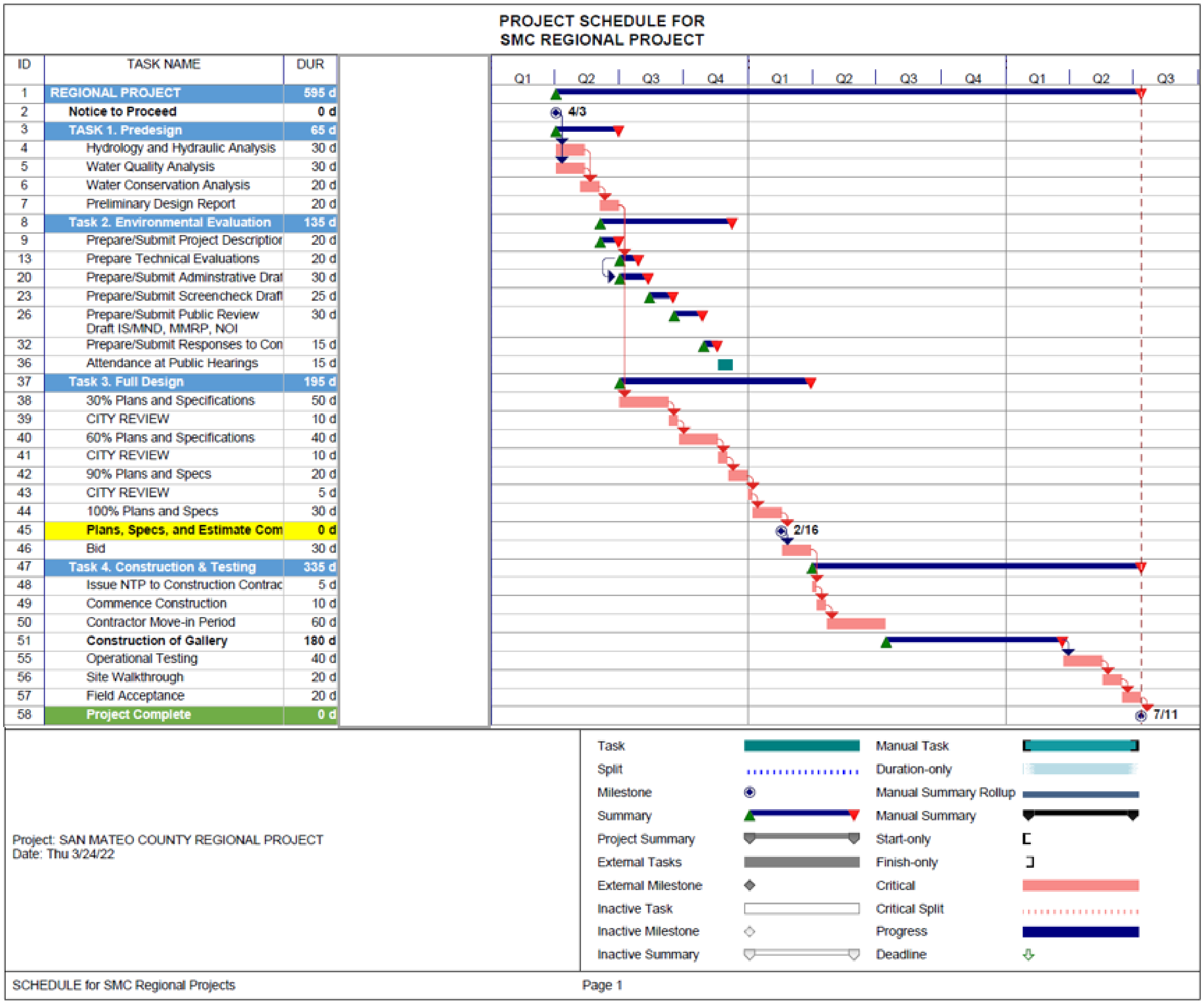


Figure 5-1. Project schedule.

6.0 CONCLUSIONS & RECOMMENDATIONS

While there are many options for the Redwood City City Hall Parking Lot Regional Project, the recommended option given the full range of identified outcomes and constraints for this project is a 5.4 ac-ft subsurface storage tank that will provide stormwater capture and treatment while also maintaining the parking lot. This storage tank will feature the following key components:

- 30 cfs diversion from the existing storm drain through a manhole junction structure,
- Gravity flow through 30-inch RCP to the pretreatment to ensure effective pollutant reduction and minimized maintenance frequency
- A 5.4 ac-ft storage tank to store the diverted stormwater,
- A pump station that pumps water from the storage tank,
- A filtration unit that treats the pumped water. The water will then be discharged within the original storm drain downstream of the diversion point. It should be noted that acceptance of the filtration devices is being discussed by the Regional Board regarding the MRP compliance needs versus the recognized BMPs/configurations for LID. No resolution has been reached to date but ongoing discussions are being had to evaluate filtration as a viable alternative.

This BMP will provide substantial pollutant reduction for runoff to Redwood Creek and will carry an estimated construction cost of $7,831,822 and an estimated annual operation and maintenance cost of $310,000. Configuration details and costs will be refined at further stages of design and may be subject to change.

7.0 REFERENCES

Bay Area Stormwater Management Agencies Association (BASMAA). 2017. *Bay Area Reasonable Assurance Analysis Guidance Document*. June 2017.

California Stormwater Quality Association (CASQA). 2003. *California Stormwater BMP Handbook – New Development and Redevelopment.*

City/County Association of Governments of San Mateo County (C/CAG). 2020*. San Mateo County-Wide Reasonable Assurance Analysis Addressing PCBs and Mercury: Phase I Baseline Modeling Report.* September 2020*.*

City/County Association of Governments of San Mateo County (C/CAG). 2022. *Advancing Regional-Scale Stormwater Management in San Mateo County: Regional Collaborative Program Framework White Paper*. January 2022.

County of San Mateo 2018. *San Mateo Plain Groundwater Basin Assessment.*

Minnesota Stormwater Steering Committee (MSSC), 2005. "The Minnesota Stormwater Manual". Developed by Emmons and Olivier Resources for the Stormwater Steering Committee, Minnesota Pollution Control Agency, St. Paul, MN. http://www.pca.state.mn.us/pyria84.

APPENDIX A: CONCEPTUAL DESIGN FACT SHEET

Note: The site configuration may be modified during final design.

REDWOOD CITY CITY HALL PROJECT – PROJECT CONCEPT DESIGN

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

C/CAG
City/County Association of Governments of San Mateo County

PROJECT LOCATION, DESCRIPTION, & PURPOSE

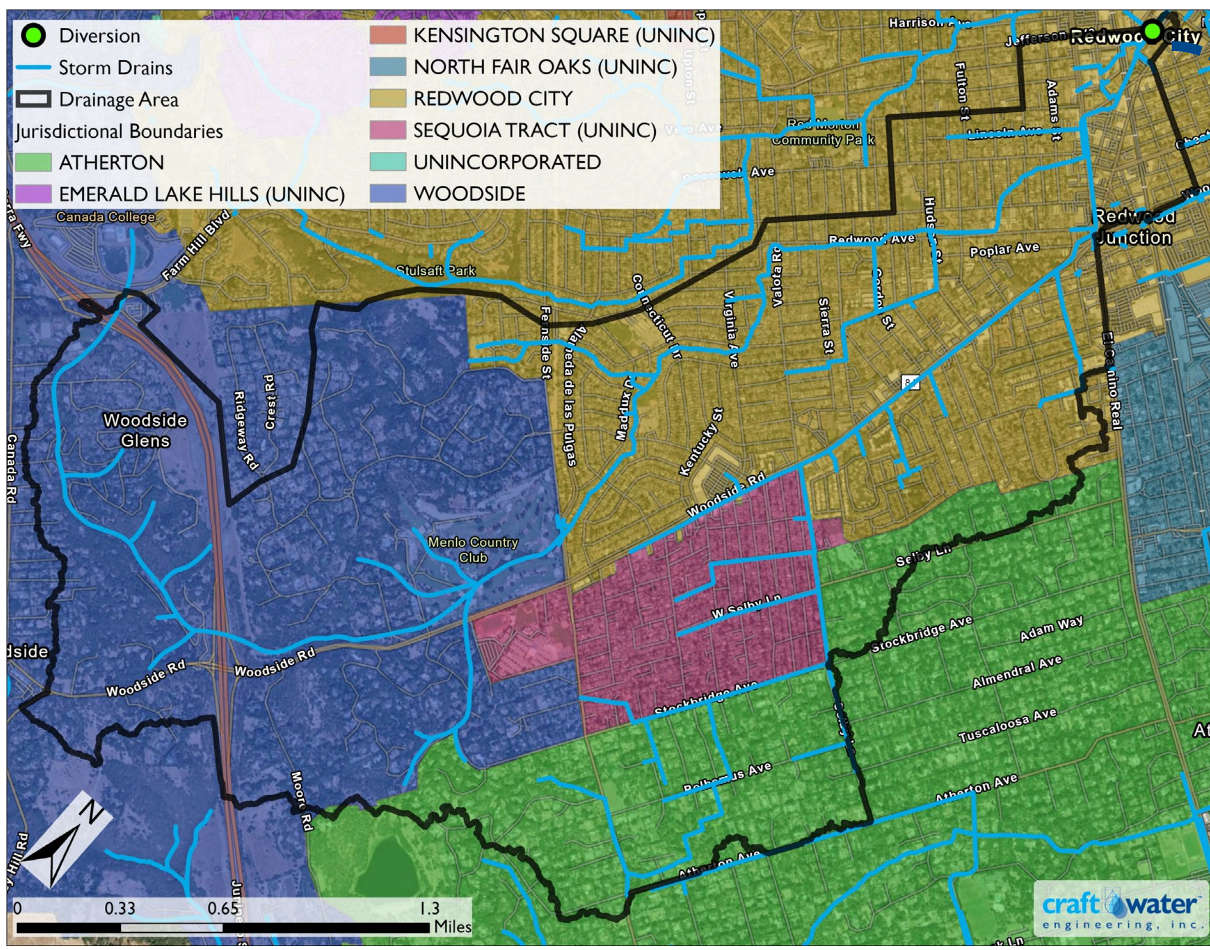
LOCATION: 1017 Middlefield Rd, Redwood City, CA 94063	**LAT**: 37°29'09.0"N, **LONG**: 122°13'37.7"W	**SITE OWNER**: City of Redwood City

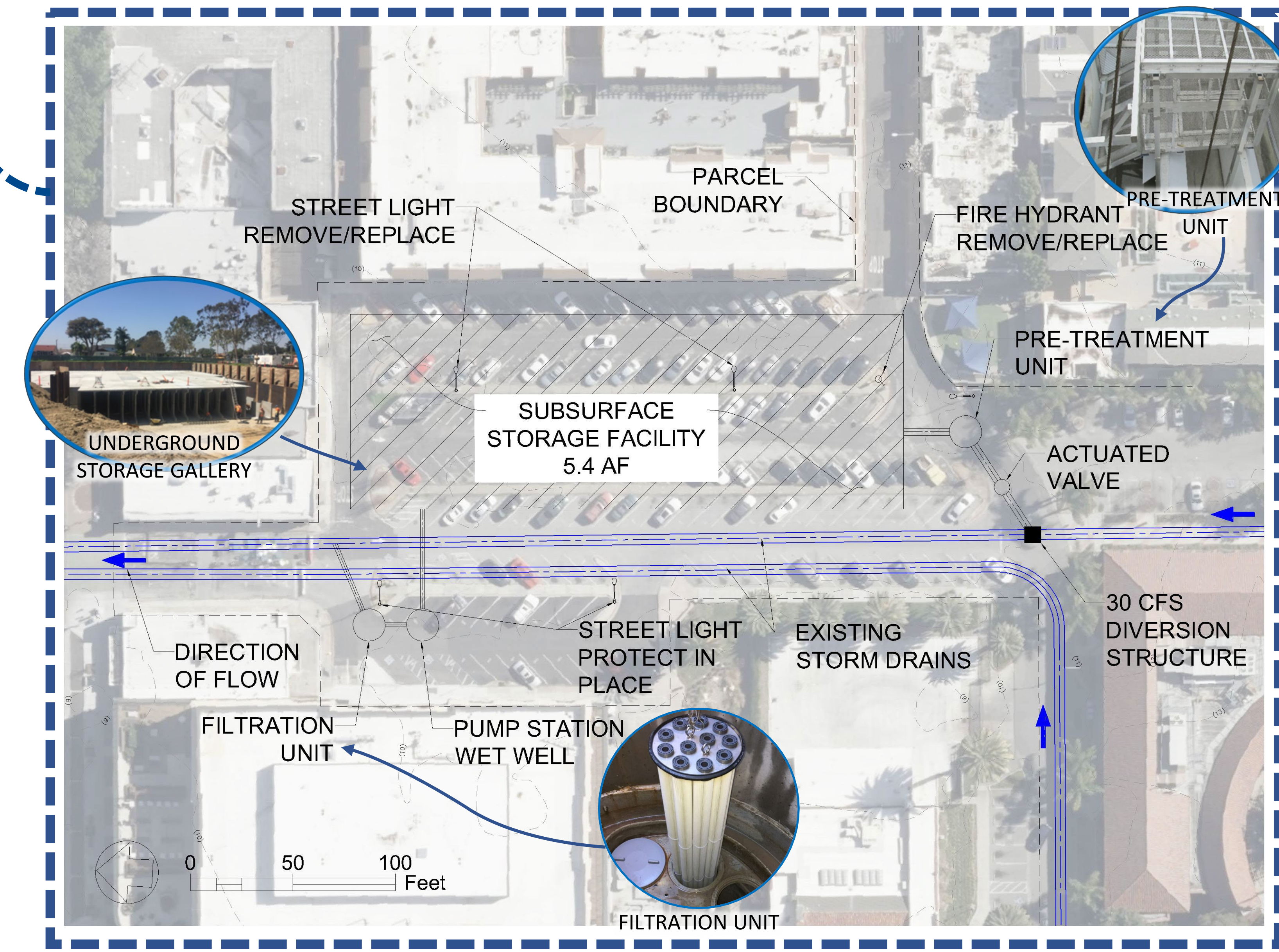
DESCRIPTION: Redwood City City Hall is owned by the City of Redwood City, CA. Flows up to 30 cfs will be diverted from a storm drain running south to north along the west side of the parking lot before discharging to Redwood Creek and then to San Francisco Bay. Diverted water will be pretreated to remove trash and sediments, and gravity fed into a 5.4-acre-foot subsurface storage facility located underneath the City Hall parking lot. Stored water will be filtered through a stormwater filtration unit and returned cleaner to the same storm drain. Upon installation of the subsurface storage, the surface would be restored back to a parking lot to maintain the existing site use. The project is sized to optimize sediment (TSS) reductions as a retrofit project with the most cost-effective sizing balancing pollutant removal and cost.

PURPOSE & NEED: San Mateo County is required to improve water quality, per the MS4 permit, in addition to providing flood protection to the residents. The most recent iteration of the Municipal Regional Permit (MRP) focuses water quality benefits on trash removal, pollutant reduction, and impervious areas managed, while the County is also interested in water supply augmentation and flood risk reduction

PROJECT BENEFITS

PCB Reduction	8.45 g/yr
Volume Managed	337.3 ac-ft/yr
Volume Reduction of 10yr, 24hr	12.5 ac-ft/yr
Peak Reduction of 10yr, 24hr	0 cfs
Water Supply Volume	0.0 ac-ft/yr
Site Water Demand Offset	0.0%
WPP Trash Generation Area Treated	173 ac
CALTRANS Trash Capture Area	178 ac
Population in Walking Distance (1/2 mi)	3,636 people



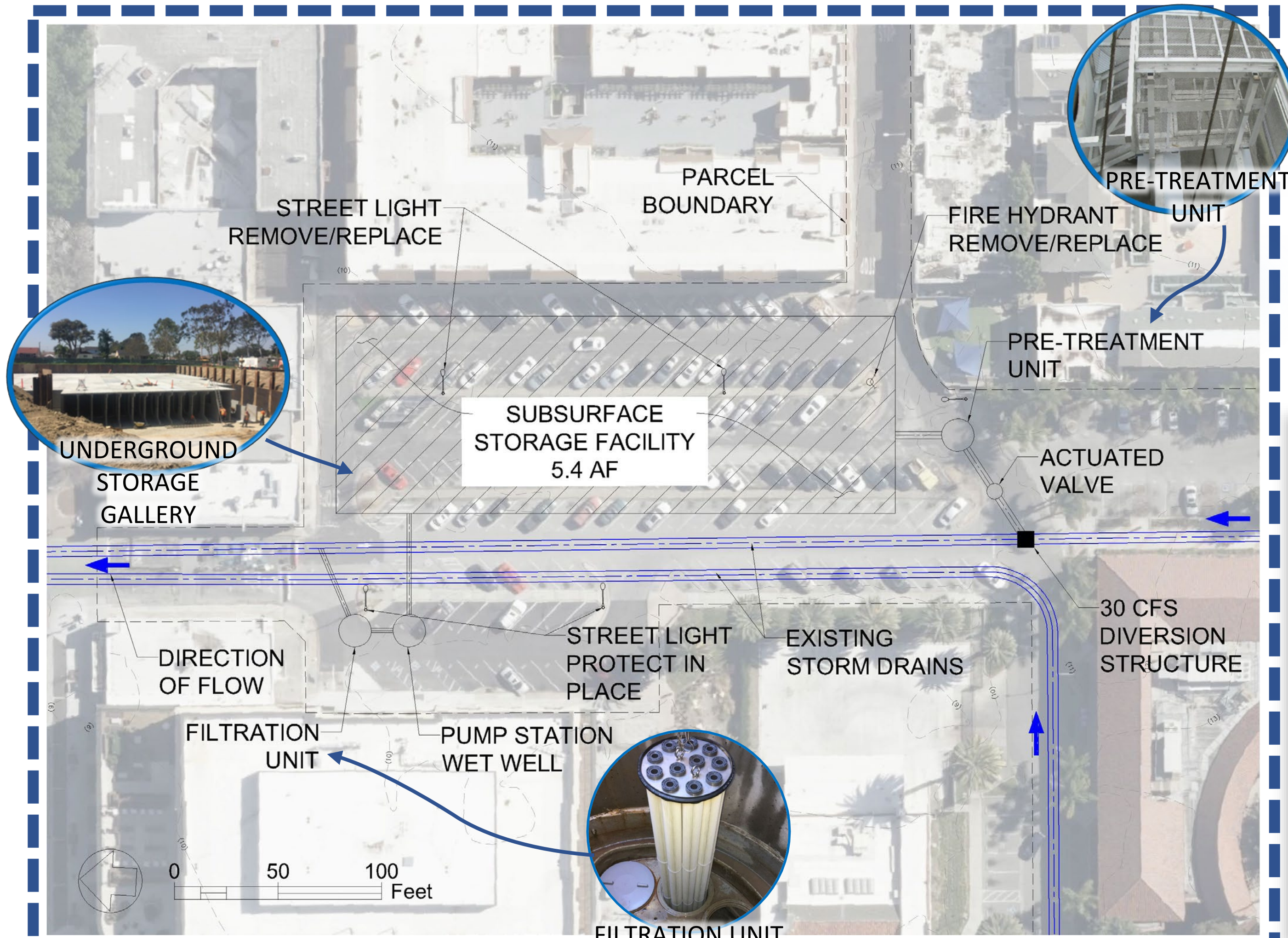


ACKNOWLEDGEMENT

This project was funded by the EPA San Francisco Bay Water Quality Improvement Fund	**Concept Prepared by:** craft water engineering, inc.

REDWOOD CITY CITY HALL PROJECT – PROJECT CONCEPT DESIGN

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY



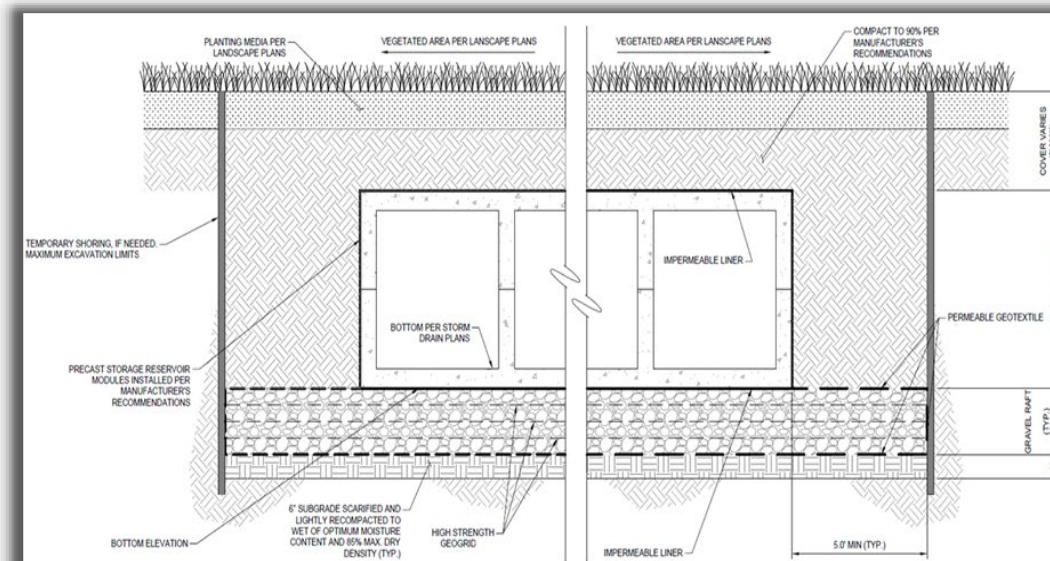
KEY PROJECT ASSUMPTIONS

The area is assumed to have HSG C soil with an infiltration rate of 0.2 - 0.5 in/hr. A pump and filter is a more cost-effective option in this scenario.

Gravity flow of diverted water to the storage is assumed to be feasible.

Two parallel storm drains are available for diversion. Modeling and design assumed a diversion from the pipe on the east (unknown size and invert).

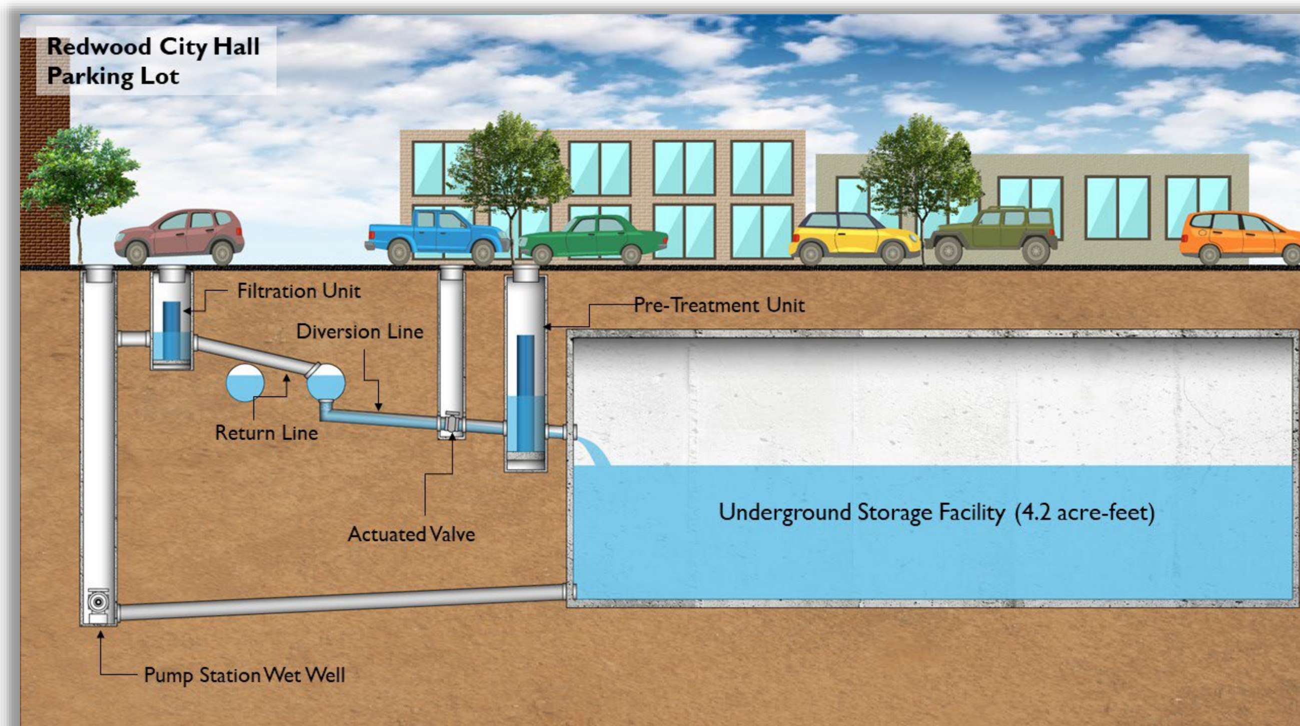
Typical Section



DRAINAGE CHARACTERISTICS

RECEIVING WATER	Redwood Creek
TOTAL DRAINAGE AREA	3,371 ac Redwood City (36.6%) Atherton (14.8%) Woodside (38.9%) County (9.7%)
TOTAL IMPERVIOUS AREA	1,471 ac
SIZING CRITERIA	Cost-effective PCB reduction
BASELINE RUNOFF (Avg)	1,262 ac-ft/yr
BASELINE PCB (Avg)	36.6 g/yr
EXISTING STORM DRAIN	Subsurface Pipe, Size Unknown

Existing Conditions



SITE DESIGN VALUES

PROJECT TYPE	Subsurface Vault
TREATMENT METHOD	Filtration
INFILTRATION RATE	0.2-0.5 in/hr (assumed)
FOOTPRINT	0.54 acres
HEIGHT	10.0 ft
DIVERSION RATE & TYPE	30 cfs (Gravity)
CAPACITY	5.4 ac-ft

REDWOOD CITY CITY HALL PROJECT – PROJECT CONCEPT DESIGN
ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

PLANNING LEVEL COST ESTIMATE

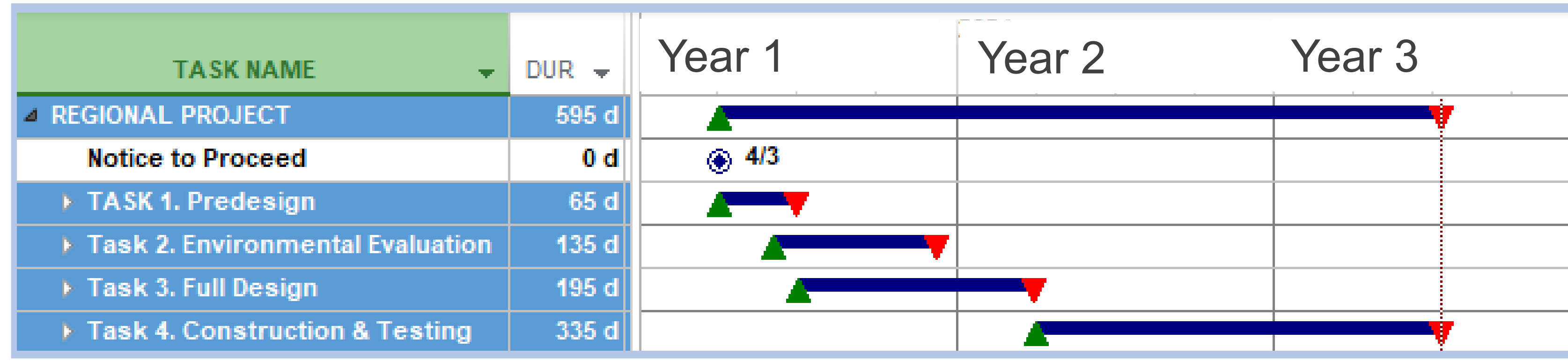
Description	Quantity	Unit	Unit Price	Total
Diversion Structure	1	EA	$95,000	$95,000
Pretreatment	1	EA	$90,000	$90,000
Diversion Pipe (30" RCP)	86	FT	$408.34	$35,118
Excavation & Site Demo	18,912	CY	$41.45	$783,951
Subsurface Infiltration Reservoir	260,663	CF	$13.28	$3,462,073
Outflow Pump & Filter	1	EA	$762,454	$762,454
Surface Restoration	28,440	SF	$14.63	$415,960
			CAPITAL SUBTOTAL	$5,644,555
Mobilization (10% capital)				$564,456
Contingency (15% capital)				$846,684
Design (10% of Capital, Mobilization, and Contingency)				$705,570
Environmental Documentation & Permitting (1% total)				$70,557
			GRAND TOTAL	$7,831,822

Assumptions:
-Full itemized cost estimated included in Appendix B
-Rough order of magnitude preliminary opinion of costs. Actual costs may vary
-Soils are not conducive to infiltration and a pump/outflow filter will be required
-Shoring is required for construction due to space limitations

PLANNING LEVEL OPERATIONS & MAINTENANCE ESTIMATE

Description	Frequency	# Times per Year	Unit Price	Total
Diversion Structure – Inspection & Cleaning	Monthly	12	$8,000	$96,000
Pretreatment Device – Vacuum	Quarterly	4	$10,000	$40,000
Post-Treatment Filter Device – Vacuum	Quarterly	4	$10,000	$40,000
Wet-well – Wet Season Inspection & Cleaning (Vacuum)	As-Needed	6	$10,000	$60,000
Valve Maintenance	Semi-Annually	2	$5,000	$10,000
Control Panel Inspection & Maintenance	Annually	1	$4,000	$4,000
Storage – Wet Season Inspection & Cleaning (Vacuum)	Quarterly	4	$10,000	$40,000
Filter – Inspection & Cleaning	Annually	1	$20,000	$20,000
			TOTAL (Annual)	$310,000

PRELIMINARY PROJECT SCHEDULE



ADDITIONAL CONSIDERATIONS

This project concept is planning-level and requires further analysis and review for full design.

Storm Drain Depth: Invert of the diverted storm drain will dictate the system depths and is presently unknown.

Geotechnical Investigation: The infiltration rates, groundwater depths, and soil suitability require a full evaluation to determine infiltrative capability of the project. Initial soils data indicate rates are not suitable for infiltration, but field-tested values are required for the full design analysis.

Utilities: Several utilities has been observed at the project site, including a fire hydrant, streetlights, storm drains, and catch basins. A full utility investigation will be required during design.

Phasing Consideration: The location serves as a primary parking location for the Redwood City downtown district and was heavily trafficked during the site visit. To allow for continuous operation of the parking lot, phasing should be considered in design.

Environmental Documentation: The project is anticipated for eligibility for a mitigated negative declaration in response to CEQA. A full project description and evaluation is required during design.

Sizing Criteria: As a stormwater capture and pollutant removal project, the MRP designated design goal is to capture 80% of the annual runoff. As such, the project is intended to maximize pollutant removal while minimizing overall costs. Project sizing used 10-years of continuous simulation to estimate the average annual PCB loading and removal by various combinations of diversion and storage.

APPENDIX B: ENGINEER'S 10% COST ESTIMATE

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **San Mateo County**
Project: **Redwood City City Hall**
Status: **10% Cost Estimate**

Prepared by: **YW**
Checked by: **MMT**
Date **4/22/2022**

Description	Qty	Unit	Unit Price	Total
Diversion Structure				**$95,000**
Temporary Diversion	1	EA	$20,000.00	$20,000
Manhole Drop Structure	1	EA	$50,000.00	$50,000
Actuated Valve and Structure	1	EA	$25,000.00	$25,000
Pretreatment				**$90,000**
Pretreatment Device (30 CFS) (Includes excavation & shoring)	1	EA	$90,000.00	$90,000
Diversion Pipe (30" RCP)				**$35,118**
Piping (30-in RCP) to storage (Includes excavation & shoring)	86	LF	$335.00	$28,810
Backfill and Compaction for Piping Base (crushed aggregate)	50	CY	$46.00	$2,308
Flap Gate	1	EA	$4,000.00	$4,000
Excavation & Site Demo				**$783,951**
Excavation	18,912	CY	$35.00	$661,931
Concrete Sidewalk & Walkway Removal	4,400	SF	$3.50	$15,400
Concrete Curb and Gutter Removal	1,100	LF	$5.00	$5,500
AC Pavement Removal	3,160	SY	$32.00	$101,120
Subsurface Storage Reservoir (5.44 AF)				**$3,462,073**
Underground Infiltration Gallery Precast Structures	260,663	CF	$10.00	$2,606,630
Shoring	656	LF	$30.00	$19,672
Installation	1	LS	$120,000.00	$120,000
Backfill and Compaction	9,258	CY	$25.00	$231,453
Hauling	9,654	CY	$28.00	$270,317
Construction Dewatering	1	LS	$150,000.00	$150,000
Maintenance Hole	4	EA	$16,000.00	$64,000
Outflow Pump, Filter, Pipe, & Valve				**$762,454**
Actuated Valve and Structure	1	EA	$25,000.00	$25,000
Piping (18" RCP) to Outfall (Includes excavation & shoring)	122	LF	$307.00	$37,454
Wet Well Installation (includes excavation & shoring)	1	LS	$100,000.00	$100,000
Submersible Pumps and Valves (7.84 cfs)	1	LS	$100,000.00	$100,000
Treatment Filter Unit (7.84 cfs)	1	EA	$500,000.00	$500,000
Surface Restoration				**$415,960**
Tree Installation	11	EA	$2,500.00	$27,500
Shrubs, Perennials, and Grasses	500	SF	$5.00	$2,500
Street Lights	2	EA	$7,000.00	$14,000
AC Paving (includes base)	28,440	SF	$9.00	$255,960
Concrete Curb and Gutter	1,100	LF	$60.00	$66,000
Fire Hydrant Replacement	1	EA	$5,000.00	$5,000
90-Day Plant Establishment Period	1	LS	$45,000.00	$45,000
SUBTOTAL				**$5,644,555**
Mobilization / Demobilization (10% capital)	1	LS	$564,456.00	$564,456
Contingency (15% capital)	15%	LS	$846,684.00	$846,684
			Construction Subtotal	**$7,055,695**
Design (10% Total)	10%	LS	$705,570.00	$705,570
Environmental Documentation & Permitting (1% total)	1%	LS	$70,557.00	$70,557
	GRAND TOTAL			**$7,831,822**

craft water engineering, inc.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client:	**San Mateo County**	Prepared by:	**YW**
Project:	**Redwood City City Hall**	Checked by:	**MMT**
Status:	**10% Cost Estimate**	Date	**4/22/2022**

Description	Qty	Unit	Unit Price	Total

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RSMeans current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforeseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

OPERATIONS AND MAINTENANCE ESTIMATE

Client: **San Mateo County**
Project: **Redwood City City Hall**

Prepared by: **MT**
Checked by: **CS**

Operations and Maintenance (Annual Estimate)

Date: **April 22, 2022**

Description	Frequency	No. of Times per Year	Unit Price	Total
Diversion Structure - Inspection and Cleaning	Monthly	12	$8,000	$96,000
Pretreatment Device - Vacuum	Quarterly	4	$10,000	$40,000
Post-Treatment Filter Device - Vacuum	Quarterly	4	$10,000	$40,000
Wet Well - Wet Season Inspection & Cleaning (Vacuum)	As-needed	6	$10,000	$60,000
Valve Maintenance	Semi-Annually	2	$5,000	$10,000
Control Panel Inspection and Maintenance	Annually	1	$4,000	$4,000
Storage - Wet Season Inspection and Cleaning (Vacuum)	Quarterly	4	$10,000	$40,000
Filter - Inspection & Cleaning	Annually	1	$20,000	$20,000

TOTAL (Annual) **$310,000**