Eureka High School Albee Stadium Stormwater Control Plan for Regulated Projects

Eureka High School
1915 J Street
Eureka, California

Prepared for:

Eureka City Schools

February 2021

020116

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QA/QC:MKF___
Reference: 020116

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Abbreviations and Acronyms

Units of Measure

CF	cubic feet
cfs	cubic feet per second
SF	square feet

Additional Terms

ADA	Americans with Disabilities Act
B-#	boring-number
DMA	drainage management area
HSG	hydrologic soil group
LID	low-impact development
MS4	Small Municipal Separate Storm Sewer System
NRCS	Natural Resources Conservation Service
O&M	operations and maintenance
PVC	polyvinyl chloride
RWQCB	North Coast Regional Water Quality Control Board
SBR	styrene-butadiene rubber

1.0 Project Information and Description

This project consists of modifying the athletic fields and adjacent facilities at Eureka High School. The proposed improvements will occur within the footprint of the school's existing athletic facilities.

1.1 Existing Conditions

Eureka High School's Albee Stadium and the adjacent facilities north of Del Norte Street were originally created by adding fill to the bottom of Cooper Gulch drainage valley. Based on historical photography, this appears to have been completed in phases, with the development of Albee Stadium pre-dating the development of facilities north of Del Norte Street.

The existing site consists of the following: track and field, softball field, baseball field, bleachers, parking lots, and various buildings. There is an existing 30" diameter concrete storm drain mainline the runs below the entire site, beginning south of the track, and ending north of the baseball field. This storm drain line conveys the flows in Cooper Gulch under the site. All runoff from the project site drains into Cooper Gulch.

1.2 Proposed Project Conditions

The proposed project consists of a variety of improvements to the school's athletic facilities on both the north and south side of Del Norte Street. See Figure 1 for a Project Location Map. See Appendix 1 for a figure showing the proposed improvements.

The improvements on the north side of Del Norte Street include:

- Demolition of the existing Agriculture Building
- Removal of portable classrooms and sheds
- Construction of a new parking lot
- Renovation of the baseball field
- Replacement of the water service for the Woodshop Building
- Construction of accessible paths of travel throughout the project site
- Installation of new storm drain piping
- Rehabilitation and replacement of the existing storm drainpipe in Cooper Gulch that runs below the site
- Construction of bioretention basins to manage and treat stormwater runoff

The improvements on the south side of Del Norte Street include:

- Replacement of the existing track and field facilities in Albee Stadium
- Installation of a new synthetic turf football field
- Renovation of the softball field
- Construction of accessible paths of travel throughout the project site

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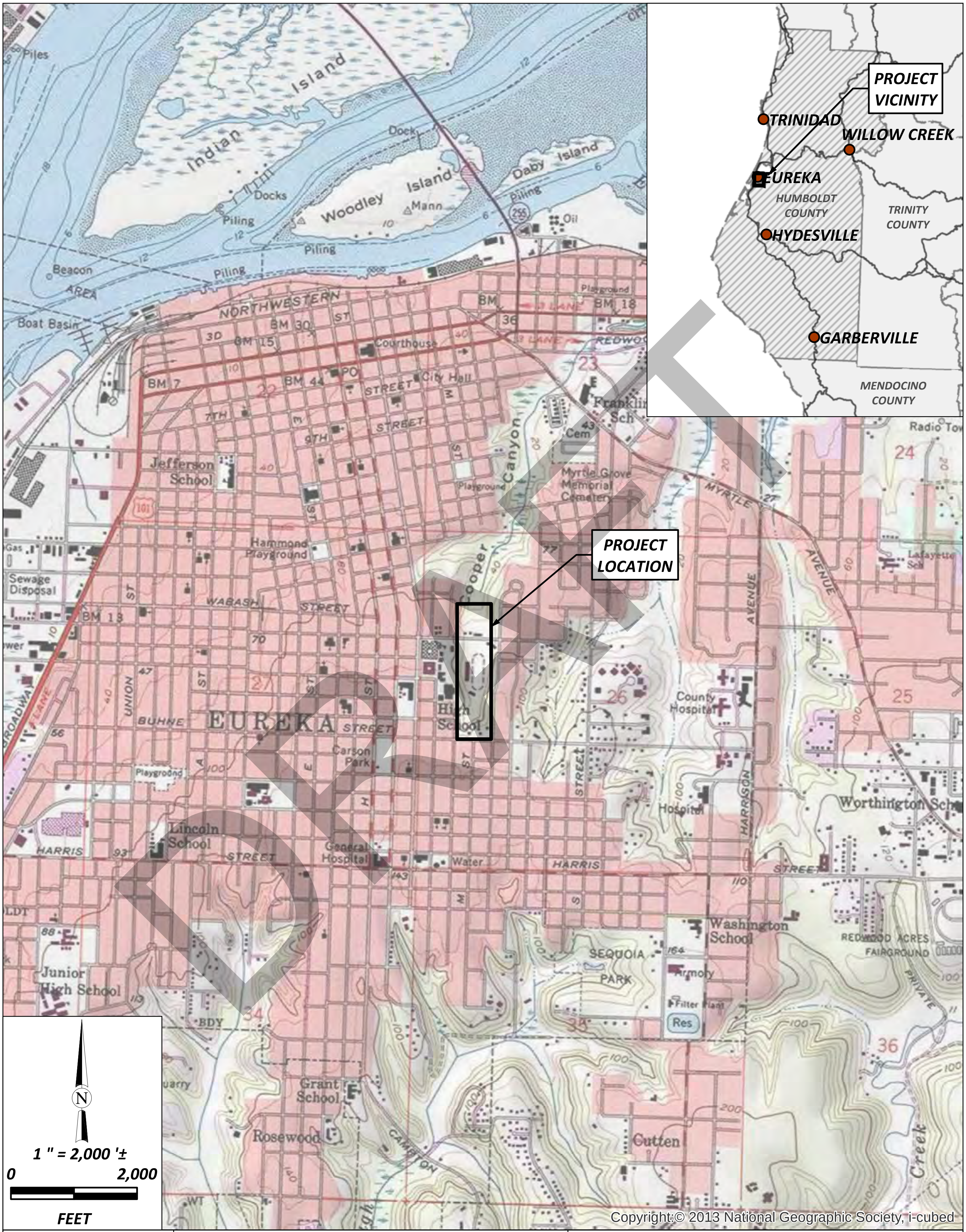

Eureka City Schools
Albee Stadium Stormwater Control Plan
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Project Location Map

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January 2021

Figure1_ProjectLocationMap

Figure 1

- Construction of two new buildings, one at the north end of Albee Stadium (Building Q), and one at the south end (Building R)
- Remodeling of the existing field house building
- Replacement of the existing parking lot
- Installation of new utilities to serve the site
- Installation of new storm drain piping
- Rehabilitation of the existing storm drainpipe in Cooper Gulch the runs below the site
- Construction of bioretention basins to manage and treat stormwater runoff

2.0 Project Stormwater Mitigation Requirements

The total project area defined by the boundary of proposed improvements to the site of 9.8 acres is presented in Figure 2. The pre-project site has an impervious surface area of 130,442 square feet (SF) (2.99 acres), and a pervious surface area of 296,552 SF (6.81 acres). The post-project site will have an impervious surface area of 155,709 SF (3.57 acres), and a pervious surface area of 271,285 SF (6.23 acres).

Because this project will create more than 5,000 SF of impervious surface, it is classified as a "Regulated Project" according to the Phase II Small Municipal Separate Storm Sewer System (MS4) Program, Section E.12.c(ii).

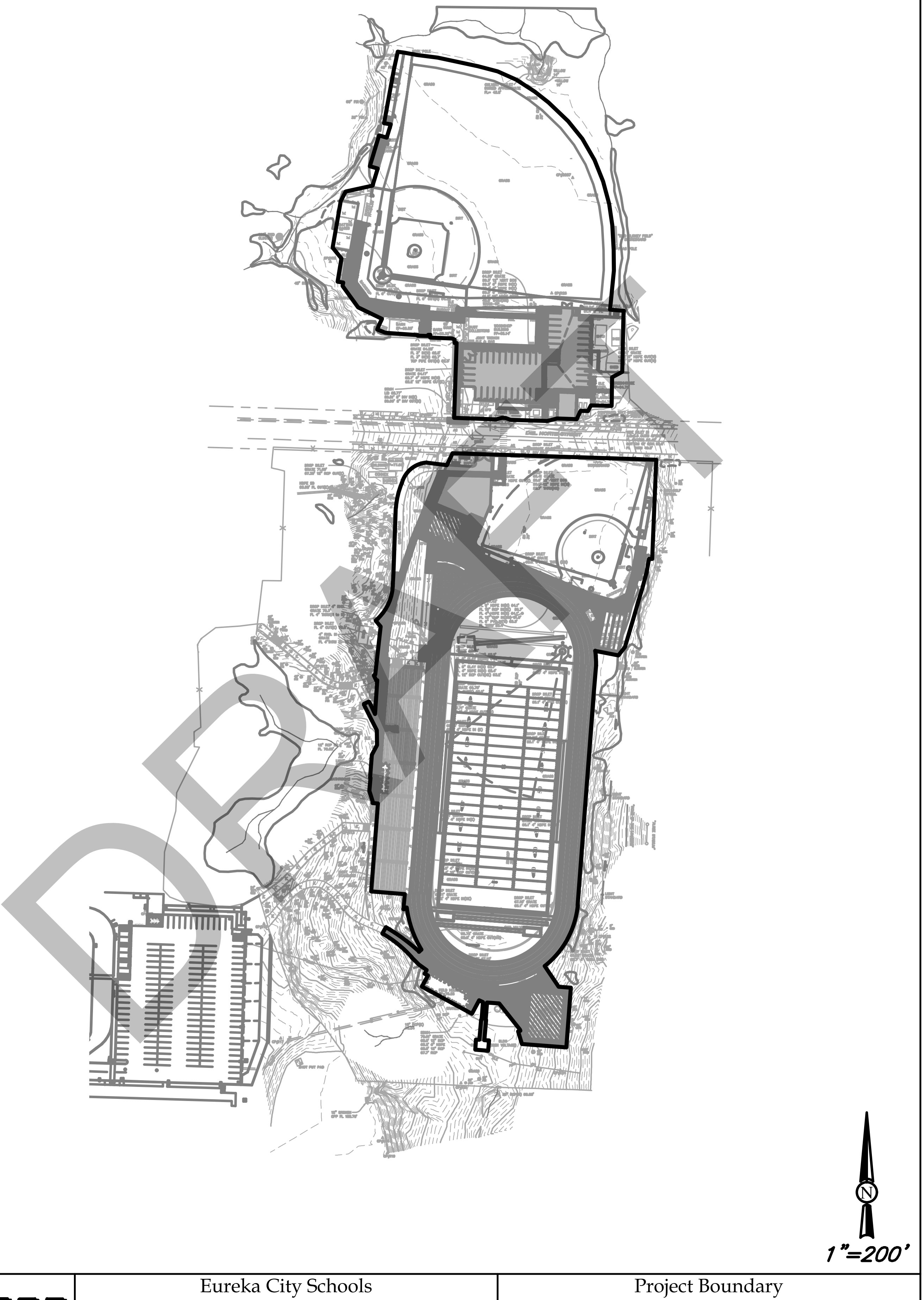
Given that the project results in an increase of less than 50% of the previously existing impervious area (this project increases impervious area by approximately 19%), stormwater runoff from new and/or replaced impervious surfaces must be mitigated according to Section E.12.c.II.a of Phase II Small MS4 Program.

This project will replace 2.21 acres of impervious surface and will create 0.58 acres of new impervious surface, resulting in a total of 2.79 acres of created or replaced impervious surface. A total of 0.78 acres of existing impervious surface will remain as-is. Because the project creates or replaces more than 1 acre of impervious surfaces, hydromodification management is required by Section E.12.f(i); which requires that the post-project runoff shall not exceed the pre-project runoff flow rate for the 2-yr, 24-hour duration storm.

The Stormwater Information Sheet, and the Stormwater Control Plan for Regulated Projects are located in Appendix 2.

3.0 Opportunities and Constraints

The following are the opportunities and constraints that were considered for the low-impact development (LID) improvements.



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Project Boundary

SHN 020116

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020116-FULL-SITE-SW-MIT-FIG

Figure 2

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Opportunities for LID include:

- Disconnection of impervious surfaces from the existing storm drain system.
- The site layout has been designed to allow for various bioretention basins to be installed across the site to manage and treat stormwater runoff from new or replaced impervious surface areas.

Constraints on the site include:

- Limited square footage is available for LID features.
- Existing topography imposes limits on potential stormwater mitigation strategies.

3.1 Track Surface Runoff Constraints

The Albee Stadium track lies at a relatively low elevation with respect to the site topography. Track design standards dictate that the track have an inward slope, which causes all runoff from the track surface to flow toward the inside perimeter of the track. Runoff from the track is captured in a trench drain that is installed along the inside perimeter of the track. The runoff is then conveyed by the trench drain to an in-line catch basin where it then flows into the site storm drain system. Due to the unique drainage configuration of a track and due to the fact that the track is located at a relatively low elevation on the site, it is not feasible to direct runoff from the track into a bioretention basin or other vegetated stormwater mitigation features.

In discussions with the North Coast Regional Water Quality Control Board (RWQCB) regarding the challenges associated with treating runoff from the track surface, and noting that runoff from the track surface is unlikely to contain contaminants, RWQCB personnel stated that they are willing to consider alternative design measures as a substitute for providing treatment for runoff from the track surface. The alternative design measure that was mentioned by the RWQCB as a possible substitute is the use of a natural infill material for the synthetic turf fields rather than the styrene-butadiene rubber (SBR) infill that is commonly used as an infill material for synthetic turf fields. Therefore, the School District has committed to using a natural infill material for its synthetic fields. Specific selection of the natural infill material has not yet been finalized, but the current plan is to use a cork-based infill product, which will likely be a mixture of cork and sand.

3.2 Bleacher Runoff Trash Capture Opportunity

Because the bleachers at the site are existing, runoff from the bleachers will not require treatment. A trench drain will be installed along the base of the bleachers (between the bleacher walkway and the new track surface. This trench drain will receive runoff from the existing bleachers and will convey this runoff to the site storm drain system. The RWQCB has requested that the trench drain be fitted with grates with small enough openings to help prevent trash from entering the storm drain system. The most commonly available “heel safe” trench drain grates can have openings as small as 0.25 inches. The trench drains along the base of the bleachers will be fitted with these “heel safe” grates in order to help prevent trash from entering the storm drain system.

4.0 Stormwater Mitigation for 85th Percentile Design Storm

Runoff for the proposed project site for the 85th percentile, 24-hour duration annual design storm was evaluated for each drainage management area (DMA) throughout the project site. The project site was divided into 15 DMAs as shown in Figure 3. Regulated projects under the MS4 are required to capture and treat excess runoff from the 85th percentile, 24-hour duration annual storm, which is 0.65-inches in the Eureka area (Humboldt County Low Impact Development Stormwater Manual v2.0).

Based on the boring logs provided in the project geotechnical report, hydrologic soil group (HSG) B, or silt loam was used for the project site calculations. Relevant site boring locations and boring logs are provided in Appendix 3. Curve number guidance from the Natural Resources Conservation Service (NRCS) TR-55 Manual is provided in Appendix 4.

Upon analysis, it was determined that solely pervious vegetated areas uphill of impervious areas did not produce runoff from the 85th percentile, 24-hour duration annual storm event. Relevant calculations are provided in Appendix 5. As indicated in the calculations, since the precipitation value of 0.65 inches is less than the potential value infiltrated into the soil (1.28 inches), runoff from vegetated areas is not produced for HSG B. Therefore, only vegetated areas that receive runoff form impervious surfaces were included in the runoff calculations for the site.

4.1 Runoff Reduction Measures

This project will use bioretention facilities and disconnected impervious areas to reduce runoff throughout the proposed project site.

4.1.1 Bioretention Facilities

Treatment of runoff from DMAs 1, 2, 3, 5, 7, 8, 11, 14, and 15 will be provided in bioretention basins. The proposed bioretention facilities full storage volume is achieved by accounting for a ponding depth and the void space in the soil media layer and the gravel layer. The volume provided by the soil and gravel layers was calculated as the sum of the bioretention facility area multiplied by the respective layer's thickness and porosity. The ponding volume provided was calculated as the sum of the ponded area multiplied by the ponded depth.

The following parameters were used for the bioretention facilities:

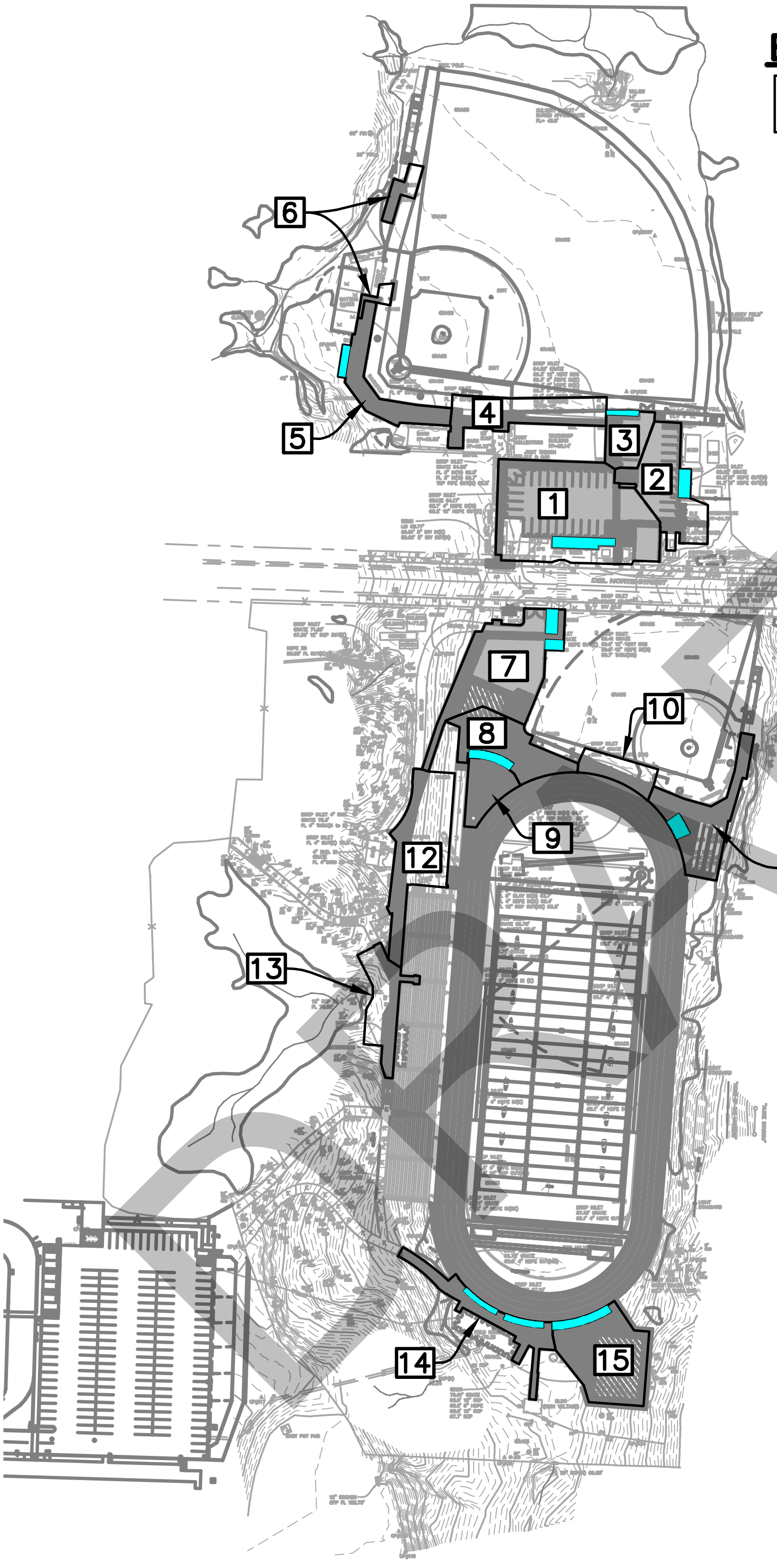
- 2-inches of ponding (100% porosity)
- 18-inch soil layer (15% porosity)
- 12-inch gravel layer (35% porosity)

Based on the specification requirements for a bioretention facility from the Humboldt County LID Stormwater Manual (included in Appendix 6), HSG A was assumed for the soil within the bioretention facilities. A bioretention facility operations and maintenance (O&M) plan, specifications, and construction checklist is included appendix 6.

Calculations for the runoff generated by each DMA with bioretention facilities are provided in Appendix 7.

EXPLANATION

15	*DRAINAGE MANAGEMENT AREA BOUNDARY AND NUMBER*
🟦	*DRAINAGE MANAGEMENT AREA BIORETENTION FACILITY*



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Drainage Management Areas and
Bioretention Facilities
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020116-FULL-SITE-SW-MIT-FIG

Figure 3

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4.1.2 Impervious Area Disconnect

Treatment of runoff from DMAs 4, 6, 9, 10, 12, and 13 will be provided through the use of impervious area disconnection. Impervious Area Disconnect Credits from the Humboldt County LID Stormwater Manual are assumed to be equal to the impervious area disconnected from the site's storm drain system, with the requirement that the impervious tributary area credit does not exceed more than twice the receiving pervious area. Having an impervious to pervious ratio less than two implies the total impervious area disconnected can be used as credit. Runoff from disconnected impervious areas is designed to flow across vegetated areas before being received by the site's storm drain system. Applicable Site Design Measure Sheets for reference from the Humboldt County LID Stormwater Manual are included in Appendix 8.

4.2 Runoff Reduction Measures by DMA

The following runoff reduction measures were established for each DMA to comply with the requirements for regulated projects as described in the Phase II Small MS4 Program.

DMA 1—North Site Parking Lot Area 1 includes the southwestern portion of the new asphalt parking lot north of Del Norte Street and driveway, sidewalks south of the existing Woodshop building and up to city right-of-way, designed to drain to a bioretention basin south and adjacent to the new parking lot. Two separate contributing areas within this DMA were analyzed, one encompassing runoff from the parking lot and sidewalk areas to the north of the bioretention basin, and one to the south consisting mostly of vegetated area. The vegetated area did not generate runoff, therefore, a composite curve number of was calculated for the contributing impervious area and the bioretention facility.

- Impervious Area = 13,622 SF
- Pervious Bioretention Area = 673 SF
- Bioretention Ponded Area = 482 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 330 cubic feet (CF); (2,469 gallons)

A summary of the design storage of the facility is presented in Table 1.

Table 1. DMA 1 Bioretention Facility Storage Capacity
Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	80.3	100	80.3
Soil Layer	18	1,009.5	15	151.4
Gravel Layer	12	673.0	35	235.6
Total				**467.3**

The bioretention facility storage capacity of 467 CF exceeds the runoff volume requirement of 330 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater levels for the two boring results (B-08-20, B-09-20) on the north side of Del Norte Street showed groundwater at 7.5 feet to 10 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 2—North Site Parking Lot Area 2 includes the majority of the eastern portion of the new asphalt parking lot north of Del Norte Street, sidewalks adjacent to the two existing greenhouses, the greenhouses, and a new storage shed to the southwest of the greenhouse area, designed to drain to a bioretention facility east of the parking lot. A composite curve number was calculated for the contributing impervious area, pervious non-bioretention receiving area, and the bioretention facility.

- Impervious Area = 6,410 square feet (SF)
- Pervious Bioretention Area = 350 SF
- Bioretention Ponded Area = 252 SF
- Pervious Non-Bioretention Area = 52 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 157 CF; (1,177 gallons)

A summary of the design storage of the facility is presented in Table 2.

Table 2. DMA 2 Bioretention Facility Storage Capacity
Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	42.0	100	42.0
Soil Layer	18	525.0	15	78.8
Gravel Layer	12	350.0	35	122.5
Total				**243.3**

The bioretention facility storage capacity of 243 CF exceeds the runoff volume requirement of 157 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater levels for the two boring results (B-08-20, B-09-20) on the north side of Del Norte Street showed groundwater at 7.5 feet to 10 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 3—North Site Parking Lot Area 3 includes a portion of the new asphalt parking lot east of and sidewalks adjacent to the existing Woodshop building, designed to drain to a bioretention facility to the northwest of the eastern portion of the new parking lot.

A composite curve number was calculated for the contributing impervious area to the south and east of the bioretention facility and the bioretention facility.

- Impervious Area = 2,666 SF
- Pervious Bioretention Area = 153 SF
- Bioretention Ponded Area = 63 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 65 CF; (487 gallons)

A summary of the design storage of the facility is presented in Table 3.

Table 3. DMA 3 Bioretention Facility Storage Capacity Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	10.5	100	10.5
Soil Layer	18	229.5	15	34.4
Gravel Layer	12	153.0	35	53.6
Total				**98.5**

The bioretention facility storage capacity of 99 CF exceeds the runoff volume requirement of 65 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater levels for the two boring results (B-08-20, B-09-20) on the north side of Del Norte Street showed groundwater at 7.5 feet to 10 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 4—Flatwork North of Woodshop Building includes a portion of the concrete walkways adjacent to the baseball field. This DMA includes 2,060 SF of impervious surface, designed to drain to the adjacent baseball field. A summary of the impervious area and receiving pervious area is presented in Table 4. The receiving pervious area shown in Table 4 only includes the infield portion of the baseball field, where runoff would proceed until it was received by main storm drain outlet to the north of the site.

Table 4. DMA 4 Impervious Area Disconnect Eureka High School Albee Stadium Project

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
2,060	875	0.81	YES

DMA 5—Baseball Field Bleacher Area includes concrete walkways and flatwork for pedestrian travel and bleachers, designed to drain to a bioretention facility west of the baseball field backstop. A composite curve number was calculated for the contributing impervious area and the bioretention facility.

- Impervious Area = 4,020 SF
- Pervious Bioretention Area = 240 SF
- Bioretention Ponded Area = 180 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 98 CF; (736 gallons)

A summary of the design storage of the facility is presented in Table 5.

**Table 5. DMA 5 Bioretention Facility Storage Capacity
Eureka High School Albee Stadium Project**

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	23.8	100	23.8
Soil Layer	18	360.0	15	54.0
Gravel Layer	12	240.0	35	84.0
Total				**161.8**

The bioretention facility storage capacity of 162 CF exceeds the runoff volume requirement of 98 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater levels for the two boring results (B-08-20, B-09-20) on the north side of Del Norte Street showed groundwater at 7.5 feet to 10 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 6—Baseball Field North Access Ramp and Storage Pad includes concrete for accessible path down to the baseball field and a storage container concrete pad and access to the baseball field. This DMA includes 708 SF of impervious surface, designed to drain to the adjacent baseball field. A summary of the impervious area and receiving pervious area is presented in Table 6. The receiving pervious area shown in Table 6 includes the infield portion of the baseball field, where runoff would proceed until it was received by the main storm drain outlet to the north of the site.

**Table 6. DMA 6 Impervious Area Disconnect
Eureka High School Albee Stadium Project**

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
708	875	0.81	YES

DMA 7—South Site Vehicle Access Area includes a new asphalt lot south of Del Norte Street, concrete walkways adjacent to new proposed building and bioretention facilities, concrete ramps south to bleachers, and the north and west portion of the roof from the new proposed building, designed to drain to two bioretention facilities to the northeast of the vehicle access lot. A composite curve number was calculated for the contributing impervious area to the south and west of the bioretention facilities and the bioretention facilities.

- Impervious Area = 10,144 SF
- Net Pervious Bioretention Area = 496 SF
- Net Bioretention Ponded Area = 342 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 246 CF; (1,838 gallons)

A summary of the net design storage of the facilities is presented in Table 7.

Table 7. DMA 7 Bioretention Facilities Net Storage Capacity
Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	57.0	100	57.0
Soil Layer	18	744.0	15	111.6
Gravel Layer	12	496.0	35	173.6
Total				**342.2**

The bioretention facilities net storage capacity of 342 CF exceeds the runoff volume requirement of 246 CF. The bioretention facilities then overflow into the site's storm drain system. Groundwater levels for the nearest boring result (B-07-20) on the south side of Del Norte Street showed groundwater at 11-feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facilities.

DMA 8—South Site Concrete Southwest of Softball Field includes the southeast portion of the new proposed building south of Del Norte Street and concrete walkways south of the new proposed building, designed to drain to a bioretention facility to the southwest. A composite curve number was calculated for the contributing impervious area to the north and east of the bioretention facility and the bioretention facility.

- Impervious Area = 5,318 SF
- Pervious Bioretention Area = 400 SF
- Bioretention Ponded Area = 264 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 94
- Design Storm Runoff Volume = 112 CF; (838 gallons)

A summary of the design storage of the facility is presented in Table 8.

Table 8. DMA 8 Bioretention Facility Storage Capacity
Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	44.0	100	44.0
Soil Layer	18	600.0	15	90.0
Gravel Layer	12	400.0	35	140.0
Total				**274.0**

The bioretention facility storage capacity of 274 CF exceeds the runoff volume requirement of 112 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater was not observed in the nearest boring result (B-03-20) on the south side of Del Norte Street to a boring depth of 26.5 feet (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 9—Shotput Field includes a concrete shotput pad and shotput field. This DMA includes 250 SF of impervious surface, designed to drain to the adjacent shotput field (2,430 SF). A summary of the impervious area and receiving pervious area is presented in Table 9.

Table 9. DMA 9 Impervious Area Disconnect
Eureka High School Albee Stadium Project

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
250	2,506	0.10	YES

DMA 10—Concrete Walkway South of Softball Field includes a concrete walkway between the south side of the softball field and running track. This DMA includes 1,120 SF of impervious surface, designed to drain to the softball field. A summary of the impervious area and receiving pervious area is presented in Table 10. The receiving pervious area shown in Table 10 only includes the softball infield portion, where runoff would proceed until received by a storm drain inlet in the northwest corner of the softball field.

Table 10. DMA 10 Impervious Area Disconnect
Eureka High School Albee Stadium Project

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
1,120	1,200	0.93	YES

DMA 11—Concrete Walkways, Softball Dugout Roofs, and Batting Cages Near Southeast Corner of Softball Field includes concrete walkways, two dugout roofs, and concrete batting cages, designed to drain to a bioretention facility to the south near the running track. A composite curve number was calculated for the contributing impervious area and the bioretention facility.

- Impervious Area = 5,712 SF
- Pervious Bioretention Area = 350 SF
- Bioretention Ponded Area = 260 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 95
- Design Storm Runoff Volume = 140 CF; (1,047 gallons)

A summary of the design storage of the facility is presented in Table 11.

Table 11. DMA 11 Bioretention Facility Storage Capacity Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	43.3	100	43.3
Soil Layer	18	525.0	15	78.8
Gravel Layer	12	350.0	35	122.5
Total				**244.6**

The bioretention facility storage capacity of 245 CF exceeds the runoff volume requirement of 140 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater was not observed in the nearest boring result (B-03-20) on the south side of Del Norte Street to a boring depth of 26.5 feet (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

DMA 12—Concrete Walkways Behind Bleachers Area 1 includes concrete walkways and ramps leading from the southern end of the ADA access ramp up from vehicle access lot adjacent to Del Norte Street, to the ADA viewing location bottom landing in the middle of the Albee Stadium Bleachers. This DMA includes 3,175 SF of impervious surface designed to drain to a vegetated area to the north and east (north of the Albee Stadium bleachers). A summary of the impervious area and receiving pervious area is presented in Table 12.

Table 12. DMA 12 Impervious Area Disconnect Eureka High School Albee Stadium Project

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
3,175	5,070	0.63	YES

DMA 13—Concrete Walkways Behind Bleachers Area 2 and Lift Structure includes concrete walkways and ramps leading from the ADA viewing area in the top of the bleachers down to the bottom landing and to the east at the tie-in location on the southern end of proposed improvements behind the stadium bleachers, which includes a vertical lift structure for access up to press box above the stadium bleachers. This DMA includes 1,944 SF of impervious surface, which is designed to drain to a vegetated area to the west of the Albee Stadium bleachers. A summary of the impervious area and receiving pervious area is presented in Table 13.

Table 13. DMA 13 Impervious Area Disconnect Eureka High School Albee Stadium Project

DMA Impervious Area (square feet)	Receiving Pervious Area (square feet)	Ratio of Impervious to Pervious Area	Ratio of Impervious to Pervious Area Less than 2?
1,944	2,190	0.89	YES

DMA 14—Fieldhouse Concrete Walkways includes concrete walkways and ADA access ramps up to existing Fieldhouse southwest of Albee Stadium running track, designed to drain to two bioretention facilities to the north near the running track. A composite curve number was calculated for the contributing impervious area and the bioretention facilities.

- Impervious Area = 4,093 SF
- Net Pervious Bioretention Area = 459 SF
- Net Bioretention Ponded Area = 229 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 92
- Design Storm Runoff Volume = 64 CF; (478 gallons)

A summary of the net design storage of the facilities is presented in Table 14.

Table 14. DMA 14 Bioretention Facilities Net Storage Capacity Eureka High School Albee Stadium Project

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	38.2	100	38.2
Soil Layer	18	688.5	15	103.3
Gravel Layer	12	459.0	35	160.7
Total				**302.1**

The bioretention facilities net storage capacity of 302 CF exceeds the runoff volume requirement of 64 CF. The bioretention facilities then overflow into the site's storm drain system. Groundwater levels for the two boring results (B-04-20, B-05-20) on the south side of the Albee Stadium running track showed groundwater at 11.5 feet to 20 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facilities.

DMA 15—New Proposed Building South of Track and Concrete Walkways includes concrete walkways and the roof downspouts from the new proposed building southeast of Albee Stadium running track, designed to drain to a bioretention facility to the north near the running track. A composite curve number was calculated for the contributing impervious area to the bioretention facility and the bioretention facility.

- Impervious Area = 7,763 SF
- Pervious Bioretention Area = 523 SF
- Bioretention Ponded Area = 346 SF
- Pervious Non-Bioretention Area = 0 SF
- Composite Curve Number = 94
- Design Storm Runoff Volume = 162 CF; (1,214 gallons)

A summary of the design storage of the facility is presented in Table 15.

**Table 15. DMA 15 Bioretention Facility Storage Capacity
Eureka High School Albee Stadium Project**

Bioretention Facility Layer	Layer Thickness (inches)	Total Layer Volume (cubic feet)	% Porosity	Bioretention Facility Runoff Storage Volume (cubic feet)
Ponding	2	57.7	100	57.7
Soil Layer	18	784.5	15	117.7
Gravel Layer	12	523.0	35	183.1
Total				**358.5**

The bioretention facility storage capacity of 358 CF exceeds the volume requirement of 162 CF. The bioretention facility then overflows into the site's storm drain system. Groundwater levels for the two boring results (B-04-20, B-05-20) on the south side of the Albee Stadium running track showed groundwater at 11.5 feet to 20 feet below the surface (results from the geotechnical investigation across the site are located in Appendix 3). Groundwater is not expected to impact the performance of the bioretention facility.

5.0 Hydromodification

The Eureka High School Albee Stadium project will replace more than an acre of impervious surface at the site (2.79 acres). Therefore, this project is designated as a hydromodification project. The performance standard for hydromodification control consists of maintaining post-project runoff at or below pre-project flow rates for the 2-year, 24-hour storm event. According to the Humboldt LID Stormwater Manual v2.0, the 2-year, 24-hour storm in Humboldt Bay MS4 areas is 2.93 inches (Appendix 9).

The hydromodification analysis was conducted using the NRCS Curve Number Method as described in the U.S. Department of Agriculture (USDA) Urban Hydrology for Small Watersheds TR-55 Manual. In order to determine the peak runoff condition for the site, two distinct analyses were calculated for pre-project and post-project peak flowrates. The first analysis was for the entire project site area where the time of concentration calculation was dictated by sheet flow and shallow concentrated flow across the baseball field, before entering Cooper Gulch to the north of the baseball field. The second analysis was for the entire site minus the athletic field pervious areas (baseball field, softball field, and football field). In the second analysis, the time of concentration was calculated from the top of the proposed ADA access ramps near the bleachers (near the top of slope north of the bleachers), to the outlet of the Cooper Gulch storm drain north of the baseball field. Based on our evaluation, the second analysis (excluding the pervious athletic field areas) was determined to produce the higher peak flow for pre-project and post-project conditions. Therefore, the pervious areas of the athletic fields were excluded in our hydromodification analysis. Under both analyses, peak flow for the post-construction condition was mitigated below the pre-project condition. The calculations performed to analyze the pre-project and post-project peak flowrates for the 2-year, 24-hour annual storm are provided in Appendix 10.

5.1 Existing Conditions

For the hydromodification calculations, without the athletic fields as mentioned previously, the existing site has a total area of 181,443 SF (4.17 acres); with an impervious surface area of 130,442 SF (3.0 acres), and a pervious surface area of 51,001 SF (1.17 acres).

Time of Concentration–The time of concentration for the project site under the existing project conditions was determined to be the less than the minimum 0.1-hour (6-minute) time of concentration for the NRCS TR-55 method, therefore the minimum 0.1-hour (6-minute) time of concentration was used. This was calculated based on the amount of time required for runoff to travel from the gravel road at the top of the slope north of the bleachers (near the top of the proposed Americans with Disabilities Act [ADA] access ramp) west of the vehicle access lot south of Del Norte Street, to the main storm drain outlet at the north end of the project site. This involved sheet flow runoff starting at the location at the top of the ADA access ramp across a grass hillside, down to a valley gutter north of the bleachers, then open channel flow through the valley gutter, then open channel flow through a 12-inch diameter concrete storm drainpipe and finally open channel flow through the 30-inch concrete storm drainpipe to the storm drain outlet (north of the baseball field).

Curve Number–A composite curve number was determined for the existing project site by calculating the areas and associated curve numbers of the various types of ground cover that exist on the site, minus the athletic fields as mentioned previously. Based on soil information provided in the geotechnical report, the subsurface soils consist of a mixture of silt loam consisting of fine and moderately fine to moderately course textures. Therefore, hydrologic soil group B was used in determining the curve numbers. The curve number and hydrologic soil group guidance information provided in the NRCS TR-55 manual is provided in Appendix 4 of this report. A composite curve number of 88 was calculated for existing conditions.

5.2 Proposed Conditions

For the hydromodification calculations, without the athletic fields as mentioned previously, the proposed site has a total area of 181,443 SF (4.17 acres); with an impervious surface area of 155,709 SF (3.58 acres), and a pervious surface area of 25,734 SF (0.59 acres).

Time of Concentration–The time of concentration for the project site under the post-project conditions was determined to be the less than the minimum 0.1-hour (6-minute) time of concentration for the NRCS TR-55 method. Therefore, the minimum 0.1-hour (6-minute) time of concentration was used. This was calculated based on the amount of time required for runoff to travel from the location at the top of the proposed ADA access ramp west of the vehicle access lot by Del Norte Street, to the main storm drain outlet at the north end of the project site. This involved sheet flow runoff from the top of the ADA ramp to a bioretention facility by Del Norte Street, then open channel flow through a 12-inch diameter polyvinyl chloride (PVC) storm drainpipe, and finally open channel flow through the rehabilitated 30-inch concrete storm drainpipe to the storm drain outlet (north of the baseball field).

Curve Number–A composite curve number was determined for the post-project site by calculating the areas and associated curve numbers of the various types of ground cover that will exist within the proposed development, minus the athletic fields as mentioned previously. Due to the high infiltration capacity associated with bioretention basins, hydrologic soil group "A" was used in determining the curve numbers for the bioretention basins, with a total bioretention facility area of 3,644 SF. Hydrologic soil group B was used for all other surface conditions. The curve number and hydrologic soil group guidance information provided in the NRCS TR-55 manual is provided in Appendix 4 of this report. A composite curve number of 92 was calculated for post-project conditions.

5.3 Hydromodification Analysis Results

The peak discharge for the 2-year, 24-hour storm will be lower under the post-project condition than it is under the pre-project condition. Based on information provided in the Humboldt LID Stormwater Manual, an infiltration rate of 5 inches per hour was used for the bioretention basins (see Appendix 6). The infiltration rate of the soil media in the bioretention facilities will reduce the post-development peak runoff rate and help to mitigate the impacts of the increased impervious surface created by the project. The hydromodification calculations are provided in Appendix 10.

A summary of the results from the hydromodification analysis is presented in Table 16.

Table 16. Hydromodification Analysis Results
Eureka High School Albee Stadium Project
(cfs)[a]

Pre-Development Peak Runoff	Post-Development Peak Runoff without Mitigation	Total Site Bioretention Infiltration (Mitigation) Rate	Post-Development Peak Runoff with Mitigation
1.86	2.22	0.42	1.80

---

[a] cfs: cubic feet per second

The post-development peak flow of 1.80 cubic feet per second (cfs) is less than the pre-development peak flow of 1.86 cfs, meeting the hydromodification requirements for the project.

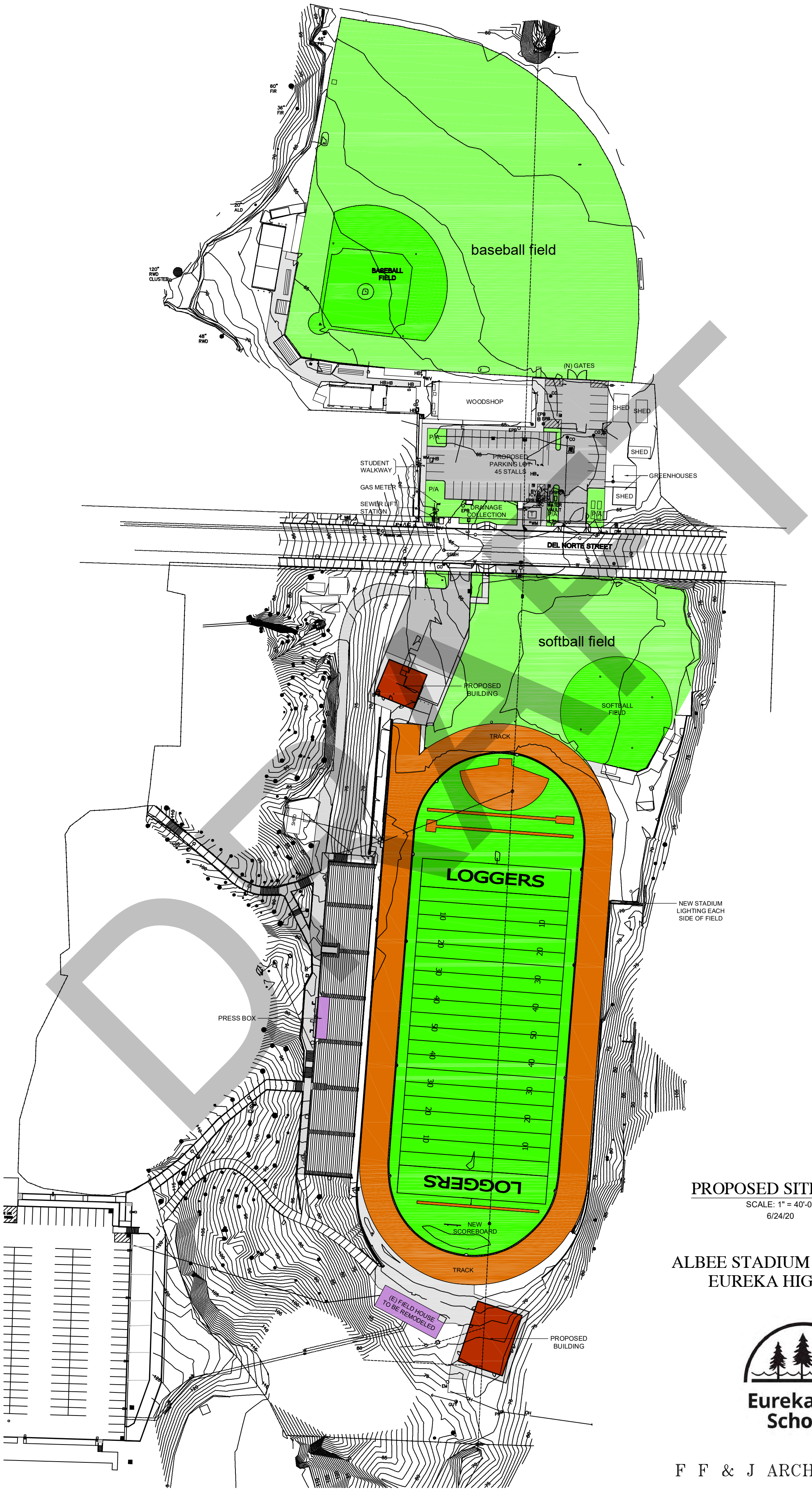
6.0 References

County of Humboldt. (June 30, 2016). Humboldt Low Impact Development Stormwater Manual v2.0. Eureka, CA:Humboldt County

U.S. Department of Agriculture. (June 1986). Urban Hydrology for Small Watersheds: TR-55. Washington, D.C.:USDA.

Proposed Site Improvements

1



PROPOSED SITE PLAN

SCALE: 1" = 40'-0"
6/24/20

ALBEE STADIUM RENOVATIONS
EUREKA HIGH SCHOOL

Eureka City Schools

F F & J ARCHITECTS, INC.

Stormwater Control Plan Completed Forms

2

STORMWATER INFORMATION SHEET

Instructions

Construction and development projects within portions of unincorporated Humboldt County (McKinleyville, the greater Eureka area, and Shelter Cove) and the Cities of Eureka, Arcata, Fortuna, and Trinidad are subject to stormwater runoff and pollution control requirements of State Water Resources Control Board Water Quality Order No. 2013-0001-DWQ; NPDES General Permit No. CAS0000004 [Municipal Separate Storm Sewer (MS4) General Permit].

The following checklist is to be completed by you (the applicant) to determine which plans and specifications for stormwater runoff control are required as part of a Building or Development Permit application for projects located in areas subject to MS4 requirements.

I. Construction Project Information and Checklist (Completed by Applicant)

Site Location Address: 1915 J Street, Eureka, California

Assessor Parcel Number (APN): 011131005, 011121001, 005246004, 005132008, 005131008

Anticipated Construction Start Date: ____

Anticipated Construction Completion Date: ____

Total area of Land Surface Disturbance: ____ square ft. or 8.8 acres

If project disturbs ≥ 1 acre of land surface then provide the State Construction General Permit WDID No.: ____

Check and/or list all applicable permits directly associated with project construction or grading activity:

☒ State Construction General Permit (CGP)
☒ State 401 Water Quality Certification
☒ U.S. Army Corps 404 Permit
☒ CA Fish and Wildlife 1600
☐ Other (list): ____

Is the construction site part of larger common plan of development or sale (check as applicable)?

☐ YES ☒ NO ☐ Unknown

Name of larger common plan/project (if applicable): ____

Impervious Surface Area:

Pre-Project Impervious Surface: 130,442 square ft.

New or Replaced Impervious Surface: 120,942 square ft.

Total Post-Project Impervious Surface: 154,138 square ft.

Check Project Type as determined from LID Manual Part A, Table 1 - Applicable Post-Construction Standards Based on Project Type

Project Type:	Notes:
☐ Exempt	Sign and Certify this form.
☐ Small Project	Sign and Certify this form. Follow instructions in Part B of LID Manual.
☐ Regulated Project	Sign and Certify this form. Follow instructions in Part C of LID Manual
☒ Regulated Project with ≥ 1 acre of created or replaced impervious surface	Sign and Certify this form. Follow instructions in Part C of LID Manual.
☐ Regulated Redevelopment, Roads, or Linear Underground Project	Sign and Certify this form. Requirements vary; contact County or City Department with project jurisdiction.

Stormwater runoff from the project site discharges to (check as applicable):

☒ Storm Drain System (including road side ditches and other conveyances)

☒ Directly to waters of the State or U.S. (e.g. river, lake, stream, ocean, wetland)
Name of Waterbody: ____

Name of nearest waterbody receiving runoff from site: Cooper Gulch

Indicate distance from project site to nearest watercourse: 0 ft.

If your project is covered under the State Water Resources Control Board Construction General Permit (CGP), attach a copy of the submitted Stormwater Pollution Prevention Plan (SWPPP) including the Notice of Intent and WDID Number.

If a CGP is not required for your project, submit appropriate construction site BMP plans as required by County or City Department with project jurisdiction.

II. Certification (Completed by Owner or Authorized Applicant/Agent)

I, the below signed, confirm that I have accurately described my project to the best of my ability, and that I have not purposely omitted any detail affecting my project's classification for stormwater regulation

Printed Name: Jared O'Barr

Signature:

Date:

III. For Official Use Only

Permit No.:

Submittal Date:

Received By:

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

For Office Use Only
Application No.____________________
Received By: ____________________

Instructions

Based on the Stormwater Information Sheet in Humboldt LID Stormwater Manual – Part A, you have determined that your project is classified as a Regulated Project. Use this form to assist you in designing your project to comply with the MS4 General Permit post-construction requirements for Regulated Projects. This completed and signed Stormwater Control Plan for Regulated Projects including additional supporting documents as required, must be submitted with your project application to the applicable PBS department with project location jurisdiction.

A. Project Information and Description

Project Name: ____________________
Physical Site Address: 1915 J Street, Eureka, California
Assessor's Parcel Number: 011131005, 011121001, 005246004, 005132008, 005131008
Project Applicant: Eureka City School District
Mailing Address: 2100 J Street, Eureka, California
Phone: 707-441-2400
Email: ____________________

Name, email and address of project consultant, if any (e.g., engineer, architect, designer):

Name: Jared O'Barr
Firm: SHN
Address: 812 W. Wabash Avenue, Eureka, CA
Phone: 707-441-8855
Email: jobarr@shn-engr.com

Type of Application/Project:
What type of application is this checklist accompanying?

☐ **Grading Permit** ☐ **Use Permit** ☐ **Subdivision**

☐ **Building Permit** ☒ **Design Review** ☐ **Other (please specify)** ____________________

Project Type and Description:	New buildings, new/replaced walkways, athletic fields, and parking/vehicle access lots.
Total Pre-Project Impervious Surface Area (square feet)	130,442
Total New or Replaced Impervious Surface Area (square feet) **[Sum of impervious area that will be constructed as part of the project]**	120,942
Total Post-Project Impervious Surface Area (square feet)	154,138

This Regulated Projects Stormwater Control Plan provides guidelines and methods for assessing site conditions, determining runoff values for site DMAs, implementing Site Design Measures with the goal of reducing stormwater runoff values from impervious surfaces, and determining the size of bioretention facilities (if required). Strategic use of site design measures may enable compliance without the need for bioretention facilities or equivalent.

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

B. Site Assessment (Opportunities and Constraints)

1. Soil Characteristics

I. Soil characterization method N/A

II. Were infiltration rates assessed for the site? ☐ Yes ☒ No

If Yes, please attach soils testing report

2. Depth to Groundwater

I. What is the depth (below ground surface) to groundwater (in feet)? 7.5-20

II. How was this determined? Soil borings in 2020

3. Existing Vegetation and Natural Areas

I. Are there any key natural vegetation areas, sensitive habitats, or mature trees on the site?

☒ Yes ☐ No

If yes, please draw and label these features on the existing conditions site plan map and attach to this document.

4. Drainage and Hydrograph

I. Are there any natural drainage or wet area features such as such as: natural ponds, springs, vernal pools, marshes, and wet meadows on the site or directly adjacent to the site?

☒ Yes ☐ No

If yes, consult with applicable PBS department staff with jurisdiction for project location as additional project area restrictions may apply.

5. Potential Contamination

I. Is the project site within or near to a registered contaminated site, according to the State Water Resources Control Board Geotracker Website (http://geotracker.waterboards.ca.gov/)?

☐ Yes ☒ No

If yes, please attach the applicable contaminated site report from the Geotracker website, and note the location of the contaminated site on the existing conditions site plan map. Please attach a description how this contamination will affect your project design.

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

C. Project Layout Optimization

Optimizing the site layout can be done through the following methods:

1. Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed.
2. Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration.
3. Limit overall impervious coverage of the site from paving and roofs.
4. Set back development from creek, wetlands, and riparian habitats, to maximize vegetative buffer widths.
5. Preserve significant trees.
6. Conform the site layout along natural landforms.
7. Avoid excessive grading and disturbance of vegetation and soils.
8. Replicate the site's natural drainage patterns.
9. Detain and retain runoff throughout the site.

Based on the features included in the existing conditions site plan, please ensure your project site plan applies project layout optimization measures to the greatest extent practicable, while still meeting the objectives of your project.

Have you attached a short description of how site optimization techniques have been integrated into the project design?

☒ Yes ☐ No

D. Source Controls

Does your project contain potential pollutant-generating activities or sources?

☐ Yes ☒ No

If Yes, please complete the Source Control Worksheet (Appendix 7) and, list and identify the source or treatment control measure and locations and include as an attachment to the SCP document.

E. Drainage Management Areas

On the project site plan please delineate and label all drainage management areas (refer to Sec. 6 of the manual).

For each Drainage Management Area identified on the project site plan, complete the Regulated Projects Runoff Worksheets (attached) to document runoff values, implementation of Site Design Measures, and bioretention facility sizing (if required). Every DMA within the project shall be listed in Worksheet 1(attached)

In accordance with section E.12 of the MS4 General Permit, Site Design Measures shall be implemented based on the objective of capturing (retaining) stormwater runoff from the 85th percentile 24-hour storm event, to the extent technically feasible. Any remaining runoff, from impervious DMAs, may then be directed to one or more bioretention facilities or equivalent. Projects over 1 acre must adhere to hydromodification standards if applicable. (refer to Sec. 5.8 of the manual).

F. Runoff Reduction Measures

Worksheet 1 provides a method for project applicants to document compliance with runoff reduction requirements through a site design methodology that directs stormwater runoff from impervious surface areas to pervious self-retaining areas for capture and infiltration (as detailed in LID Manual – Section 6.0). Using this methodology, all stormwater runoff from the 85th percentile 24-hour storm event for each DMA can be captured and retained on site and compliance with the MS4 General Permit runoff reduction requirements can be met.

Capturing stormwater runoff using the site design methodology where runoff from impervious surface areas is directed to pervious self-retaining areas is a convenient alternative for achieving compliance with the MS4 General Permit runoff reduction requirements, while avoiding the need for bioretention facilities. Worksheet 1 provides a simple calculation for determining if stormwater runoff reduction measures have been met using this design methodology.

Due to site constraints, not all projects or project DMAs may be able to achieve compliance with runoff reduction requirements by directing impervious surface stormwater runoff to pervious self-retaining areas. The project applicant will need to complete Worksheet 2 for each DMA (*6.0 Documenting Your Design*) that cannot meet compliance with runoff reduction measures as determined using Worksheet 1.

Worksheet 2 will be used to apply Site Design Measures in addition to any pervious self-retaining areas with the goal of reducing stormwater runoff values from impervious surfaces such that a no net stormwater runoff value (using the design storm) for each DMA is achieved. The worksheet process is an iterative exercise. If compliance cannot be met during the first iteration of calculations alter the site design measures to increase capturing capacity and rerun the calculator.

Site Design Measures include the following:

☐ 1. Tree Planting and Preservation
☐ 2. Rain Barrels or Cisterns
☒ 3. Impervious Area Disconnection
☐ 4. Soil Quality Improvement
☐ 5. Green Roof
☐ 6. PPPP (alternative engineered hardscapes)
☐ 7. Vegetated Swales
☐ 8. Stream Setbacks and Buffers
☐ 9. On-site Infiltration (trench, dry well, gallery, or system)

Multiple Site Design Measures may be applied to best meet site conditions in order to reduce stormwater runoff values from impervious surface areas.

After application of Site Design Measures, any remaining stormwater runoff from each DMA, must then be directed to one or more bioretention facilities or equivalent in accordance with Section 6.3 of the manual and the MS4 General Permit.

G. Bioretention Facility

Indicate whether a Bioretention Facility or equivalent is required for this project.

☒ Yes ☐ No

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

H. Operation and Maintenance in Perpetuity

Indicate whether an *Operation and Maintenance Plan* is accompanying this document, required for bioretention facilities or equivalent).

☒ Yes ☐ No

I. Signature and Certification:

This Stormwater Control Plan is required for all Regulated Projects. This document will be used by the plan checker to confirm that adequate storm water control measures are being implemented on the project.

Indicate whether all supporting materials and worksheets are accompanying this document, Stormwater Control *Plan*

☒ Yes ☐ No

I, the below signed, confirm that I have accurately described my project to the best of my ability, and that I have not purposely omitted any detail affecting my project's classification for storm water regulation. I hereby certify that the site design measures and storm water flow treatment measures identified herein as being incorporated into my project have been designed in accordance with the Site Design Measure sheets or equivalent and are included in the final site plans submitted to the applicable Planning and/or Building Services Department with project location jurisdiction. I also hereby certify that my project meets the storm water runoff reduction criteria identified in the SCP, or as determined through other approved means.

Signature

Date

Print Name

I am the:

☐ Property Owner ☐ Contractor ☒ Applicant

≥

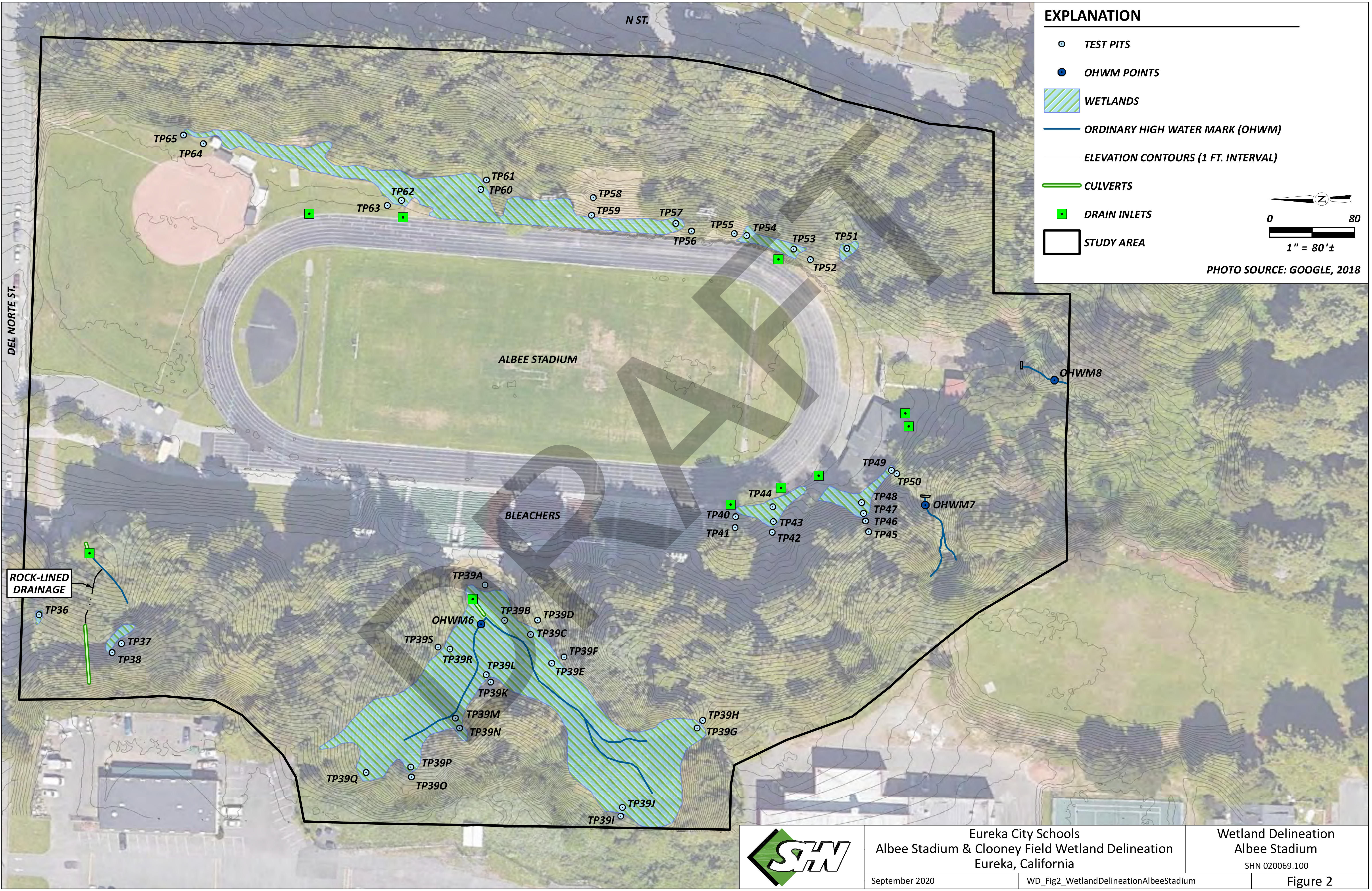
J. Checklist:

Items on Site Plan

- ☐ Site Boundary
- ☐ Soil types and areal extents. Test pit/infiltration test locations (if required)
- ☐ Environmentally-sensitive areas and areas to be preserved
- ☐ Existing natural hydrological features (depressions, watercourses, wetlands, riparian areas, undisturbed natural areas)
- ☐ Existing and proposed sited drainage network and connections to MS4 conveyances off-site
- ☐ Proposed site design measures used to reduce runoff
- ☐ DMA delineation labeled with unique identifier
- ☐ Proposed locations and footprints of improvements creating new, or replaced, impervious surfaces
- ☐ Locations and footprints of bioretention (treatment/baseline hydromodification) facilities (if required)
- ☐ Areas of soil and/or groundwater contamination
- ☐ Existing utilities and easements
- ☐ Pollutant generation source areas, including loading docks, food service areas, refuse areas, outdoor processing and storage areas, vehicle cleaning facilities/areas, repair or maintenance areas, fuel dispensing area, equipment washing areas

Items within the SCP

- ☐ Narrative of site features and conditions that constrain or provide opportunity for stormwater control
- ☐ Narrative describing the use of runoff reduction measures (sec. F), building features, pavement selections, etc., that reduce runoff
- ☐ Completed Worksheet 1 self-retaining area
- ☐ Completed Worksheet 2 site design runoff reduction measures for each DMA
- ☐ Treatment/Bioretention Operation and Maintenance Plan, including: inspection and , maintenance schedule, checklist and certification form and legally binding agreement
- ☐ Bioretention Checklist (if utilized)
- ☐ Narrative describing (treatment/ baseline hydromodification)/bioretention facilities including the calculations and location of each facility.
- ☐ Source Control Worksheet (if required)
- ☐ Soil percolation/infiltration testing documentation



Eureka City Schools
Albee Stadium & Clooney Field Wetland Delineation
Eureka, California

Wetland Delineation
Albee Stadium
SHN 020069.100

September 2020

WD_Fig2_WetlandDelineationAlbeeStadium

Figure 2

\\Arcata\Projects\GIS-Files\Eureka\2020\020069-EHS-Albee\PROJ_MXD\ USER:jsousa DATE:10/6/2020

EXPLANATION

⊙	TEST PITS
●	OHWM POINTS
▨	WETLANDS
—	ORDINARY HIGH WATER MARK (OHWM)
—	ELEVATION CONTOURS (1 FT. INTERVAL)
═	CULVERTS
🟩	DRAIN INLETS
☐	STUDY AREA

N

0 80

1" = 80'±

PHOTO SOURCE:
USGS NAIP, 2018

SHN

Eureka City Schools
Albee Stadium & Clooney Field Wetland Delineation
Eureka, California

Wetland Delineation
Clooney Field
SHN 020069.100

September 2020

WD_Fig3_WetlandDelineationClooneyField

Figure 3

\\Arcata\Projects\GIS-Files\Eureka\2020\020069-EHS-Albee\PROJ_MXD\ USER:jsousa DATE:10/6/2020

Soil Boring Figure and Results

3

IMAGE SOURCE: GOOGLE EARTH, DATED 6/3/2018

ELEVATION DATA SOURCE: CALIFORNIA COASTAL CONSERVANCY, 2009-2011

Eureka City Schools
Albee Stadium Geotechnical Investigation
Eureka, California

Site Map with Geotechnical
Boring Locations
SHN 020010.100

November 2020

Figure2_SiteMap_nov

Figure 2

Path: \\eureka\projects\2020\020010-EHSvoidInvest\100-field-invest\GIS\PROJ_MXD\Figure2_SiteMap_nov.mxd User Name: psundberg DATE: 11/16/20, 11:45AM

BORING NUMBER B-03-20

PAGE 1 OF 1

CLIENT Eureka City Schools District

PROJECT NAME Albee Stadium, Eureka High School

PROJECT NUMBER 020010.100

PROJECT LOCATION Eureka, California

DATE STARTED 7/28/20 **COMPLETED** 7/28/20

GROUND ELEVATION **HOLE SIZE**

DRILLING CONTRACTOR Taber Drilling

GROUNDWATER DEPTH

DRILLING METHOD Solid Flight Augers

▽ **AT TIME OF DRILLING** --- Not Encountered

LOGGED BY P. Sundberg **CHECKED BY** J. Dailey

▼ **AT END OF DRILLING** ---

NOTES Backfilled with cement grout

▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		POORLY GRADED SAND; loose, gray, non-cemented (FILL).										
		SILTY SAND; loose, moist to wet, mottled brown to bluish-gray, non-cemented to weak cementation.	MC		5-6-5 (11)		106	15				
			SPT		2-4-3 (7)							22
5		Wet.	MC		4-5-4 (9)		106	17				
		Bluish-gray.	SPT		3-2-2 (4)							28
10		(ML) SANDY SILT; medium stiff, moist to wet, very dark brown, fine sand, organic rich, roots (COLLUVIUM?).	SPT		2-3-4 (7)							22
		(SM) SILTY SAND; loose, wet, brownish-gray, fine to medium sand, non-cemented.										
15		(CL) LEAN CLAY WITH SAND; medium stiff to stiff, moist, bluish-gray, low to medium plasticity, fine sand, rootlets (ALLUVIUM?).	SPT		2-3-5 (8)							
20		No organics.	SPT		4-5-7 (12)							
25		(CL) LEAN CLAY WITH SAND; stiff, moist, dark bluish-gray, low to medium plasticity.	SPT		5-5-7 (12)							

Bottom of borehole at 26.5 feet.

BORING NUMBER B-04-20

PAGE 1 OF 2

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California
DATE STARTED 7/29/20 **COMPLETED** 7/29/20
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR Taber Drilling
GROUNDWATER DEPTH
DRILLING METHOD Solid Flight Augers/ Mud Rotary
∇ **AT TIME OF DRILLING** 11.50 ft
LOGGED BY P. Sundberg **CHECKED BY** J. Dailey
▼ **AT END OF DRILLING** ---
NOTES Backfilled with cement grout
▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0		SANDY SILT; moist, very dark brown (FILL).										
		SILTY SAND; loose to medium dense, moist, mottled yellowish-brown, weak cementation, fine to medium sand.	MC		15-17-11 (28)		103	9				
			SPT		5-4-3 (7)							
5			MC		3-3-3 (6)		80	10				
		(SM) SILTY SAND; loose, moist, gray, fine sand, non-cemented, 25% fines.	SPT		2-1-2 (3)							
		(SM) SILTY SAND; very loose, moist, brownish-gray, non-cemented, 40% fines, charcoal, organics (ALLUVIUM).										
10												
		∇ Saturated, coarse sand, wood fragment.	MC		7-10-10 (20)		89	20				31
			SPT		2-1-2 (3)							
		(CL) LEAN CLAY WITH SAND; soft, moist, bluish-gray, medium plasticity.										
15												
		Becomes stiff, increase in fine sand.	MC		5-7-13 (20)	>4.5						
20												
			SPT		4-4-6 (10)							
25												
		Becomes stiff.	MC		4-5-9 (14)	3.25						
30												

(Continued Next Page)

BORING NUMBER B-04-20

PAGE 2 OF 2

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
30		(SC) CLAYEY SAND; very dense, moist to wet, dark bluish-gray, weak cementation, abundant shells (HOOKTON FORMATION).	SPT		7-23-30 (53)							
35			MC		50/5"							
		(SP-SM) POORLY GRADED SAND WITH SILT; very dense, moist, dark bluish-gray, fine sand, weak cementation, abundant shells.	SPT		19-35-38 (73)							
40			MC		40-50/5"							
45			SPT		23-40-43 (83)							
50		(SM) SILTY SAND; very dense, wet, dark bluish-gray, fine sand, weak cementation, abundant shells.	SPT		29-28-33 (61)							

Bottom of borehole at 51.5 feet.

BORING NUMBER B-05-20

PAGE 1 OF 1

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California
DATE STARTED 7/29/20 **COMPLETED** 7/29/20
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR Taber Drilling
GROUNDWATER DEPTH
DRILLING METHOD Solid Flight Augers
▽ **AT TIME OF DRILLING** 20.00 ft
LOGGED BY P. Sundberg **CHECKED BY** J. Dailey
▼ **AT END OF DRILLING** ---
NOTES Backfilled with cement grout
▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SILTY SAND; loose to medium dense, moist, brown, fine sand, non-cemented (FILL).										
			MC		5-6-6 (12)		89	25				
			SPT		3-3-5 (8)							
5			MC		6-8-11 (19)		90	13				
		POORLY GRADED SAND WITH SILT; loose, moist to wet, gray, fine to medium sand, non-cemented, some wood fragments.	SPT		5-5-5 (10)	1.0						
		(CL) LEAN CLAY; medium stiff, moist, bluish-gray, low plasticity.										
10		(CL) LEAN CLAY WITH SAND; stiff, moist, bluish-gray, low to medium plasticity, fine sand.	MC		2-5-9 (14)	3.25						
			SPT		3-4-6 (10)							
15		Very Stiff.	MC		7-11-14 (25)	4			26	21	5	80
20		▽	SPT		5-6-9 (15)							
25		Very Stiff.	SPT		6-9-12 (21)							
		(CL) SANDY LEAN CLAY; stiff, moist, dark bluish-gray, low plasticity, fine sand, shells.										

Bottom of borehole at 26.5 feet.

BORING NUMBER B-06-20

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California
DATE STARTED 7/29/20 **COMPLETED** 7/29/20
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR Taber Drilling
GROUNDWATER DEPTH
DRILLING METHOD Solid Flight Augers/ Hollow Stem Augers
▽ **AT TIME OF DRILLING** 1.00 ft Perched water at 1 ft, dry below 6.5 ft.
LOGGED BY P. Sundberg **CHECKED BY** J. Dailey
▼ **AT END OF DRILLING** ---
NOTES Backfilled with cement grout
▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		(SP) POORLY GRADED GRAVEL WITH SILT AND SAND; loose, ▽ 3/4-inch diameter subrounded gravel, wet.										
		(SW-SM) WELL GRADED SAND WITH SILT AND GRAVEL; medium dense, wet, gray, non-cemented.	SPT		5-8-10 (18)							9
		(SM) SILTY SAND; medium dense, wet, bluish-gray, fine sand, non-cemented.										
5		Some coarse rounded sand.	MC		10-13-18 (31)		112	17				
		(CL) SANDY LEAN CLAY; stiff, moist, bluish-gray, low to medium plasticity, fine sand.	SPT		2-3-6 (9)							6
		(CL) LEAN CLAY; stiff, moist, bluish-gray, low to medium plasticity.	MC		3-6-8 (14)	2	97	25				
10			SPT		4-6-10 (16)							
15		(CL) SANDY LEAN CLAY; stiff, moist, bluish-gray, fine sand, low to medium plasticity.	SPT		4-6-8 (14)	3.25						
20			MC		5-6-12 (18)	3.5						
25		Increase in sand content (40%).	SPT		5-6-9 (15)							

Bottom of borehole at 26.5 feet.

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BORING NUMBER B-07-20

CLIENT Eureka City Schools District

PROJECT NAME Albee Stadium, Eureka High School

PROJECT NUMBER 020010.100

PROJECT LOCATION Eureka, California

DATE STARTED 7/30/20 **COMPLETED** 7/30/20

GROUND ELEVATION **HOLE SIZE**

DRILLING CONTRACTOR Taber Drilling

GROUNDWATER DEPTH

DRILLING METHOD Solid Flight Augers

▽ **AT TIME OF DRILLING** 11.00 ft

LOGGED BY P. Sundberg **CHECKED BY** J. Dailey

▼ **AT END OF DRILLING** ---

NOTES Backfilled with cement grout

▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	▩	SILTY SAND; moist, brown (FILL).										
	▩	CLAYEY SAND; loose, moist, yellowish-brown, non-cemented, fine to medium sand.	MC		4-4-3 (7)		98	19				
	▩		SPT		1-0-1 (1)							
5	▩	SILTY SAND; very loose, moist, brown, fine to medium sand, non-cemented.	MC		2-1-1 (2)		90	15				
	▩		SPT		1-1-1 (2)							24
10	▩	▽ CLAYEY SAND; very loose, moist to wet, gray, cohesive, fine to medium sand.	MC		1-1-2 (3)		104	20				35
	▩		SPT		1-1-1 (2)							42
15	⁙	(SM) SILTY SAND; very loose, wet, grayish-brown.	MC		3-1-1 (2)							
	ⱳ	(ML) PEAT; very soft, wet, dark brown, organic rich SANDY SILT.										
20	⁙	(SM) SILTY SAND; loose, moist to wet, dark gray, fine to medium sand, few organics.	SPT		3-3-3 (6)							28
25	▨	(SC) CLAYEY SAND; loose to medium dense, wet, grayish-brown, slightly cohesive, fine to medium sand.	SPT		5-3-7 (10)							23

Bottom of borehole at 26.5 feet.

BORING NUMBER B-08-20

PAGE 1 OF 2

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California
DATE STARTED 7/30/20 **COMPLETED** 7/30/20
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR Taber Drilling
GROUNDWATER DEPTH
DRILLING METHOD Solid Flight Augers/ Mud Rotary
▽ **AT TIME OF DRILLING** 7.50 ft
LOGGED BY P. Sundberg **CHECKED BY** J. Dailey
▼ **AT END OF DRILLING** ---
NOTES Backfilled with cement grout
▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		POORLY GRADED SAND; loose, brownish-gray (FILL).										
		Medium dense, moist, grayish-brown, non-cemented.	MC		7-10-11 (21)		99	5				
			SPT		3-2-2 (4)							
5			MC		4-4-4 (8)		95	5				
		▽ Becomes wet.	SPT		1-3-4 (7)							4
		SILTY SAND; loose, moist, dark brown, weak cementation.										
10		Gray and brown (mixed), strongly cemented, red nodules.	MC		5-5-7 (12)							
		POORLY GRADED SAND WITH SILT; medium dense, moist to wet, dark gray, charcoal fragments.	SPT		6-9-5 (14)							7
		CLAYEY SAND WITH GRAVEL; medium dense, moist, dark gray, fractured rock broken by sampler.										
15		WELL GRADED SAND WITH SILT; loose, moist, dark brown, fine to medium sand, some wood fragments.	SPT		2-3-4 (7)							11
		POORLY GRADED SAND WITH SILT; loose, moist to wet, gray, non-cemented.										
20		SILTY SAND; loose, wet, gray, non-cemented.	MC		2-3-7 (10)							12
		(ML) PEAT; soft to medium stiff, wet, dark brown, organic rich SANDY SILT (NATIVE).										
25		(SW-SM) WELL GRADED SAND WITH SILT; loose, wet, gray, non-cemented, rootlets and organics.	SPT		4-3-2 (5)							8
30												

(Continued Next Page)

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BORING NUMBER B-08-20

CLIENT Eureka City Schools District
PROJECT NAME Albee Stadium, Eureka High School
PROJECT NUMBER 020010.100
PROJECT LOCATION Eureka, California

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
30		(SC) CLAYEY SAND; medium dense, wet, gray, cohesive. Increase in fines.	MC		11-17-11 (28)							47
35		(CL) SANDY LEAN CLAY; stiff, moist, bluish-gray, fine to medium sand, low plasticity, organics.	SPT		3-4-7 (11)				34	19	15	78
40		Very stiff.	MC		6-10-17 (27)	3.0						
45		(SM) SILTY SAND; dense, moist to wet, bluish-gray, non-cemented, fine to medium sand, 15% fines.	SPT		11-15-19 (34)							
50		Very dense.	SPT		23-27-36 (63)							

Bottom of borehole at 51.5 feet.

BORING NUMBER B-09-20

PAGE 1 OF 1

CLIENT Eureka City Schools District

PROJECT NAME Albee Stadium, Eureka High School

PROJECT NUMBER 020010.100

PROJECT LOCATION Eureka, California

DATE STARTED 7/30/20 **COMPLETED** 7/30/20

GROUND ELEVATION **HOLE SIZE**

DRILLING CONTRACTOR Taber Drilling

GROUNDWATER DEPTH

DRILLING METHOD Solid Flight Augers

∇ **AT TIME OF DRILLING** 10.00 ft

LOGGED BY P. Sundberg **CHECKED BY** J. Dailey

▼ **AT END OF DRILLING** ---

NOTES Backfilled with cement grout

▼ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		POORLY GRADED SAND; loose, gray (FILL).										
		Medium dense, wet, gray, non-cemented, fine to medium sand.	MC		5-8-10 (18)		102	19				
5		SILTY SAND; loose, moist, dark brown, fine sand, weak cementation, 40% fines.	SPT		3-2-3 (5)							
			MC		2-2-2 (4)		90	26				
			SPT		1-1-2 (3)							
10	∇		MC		2-1-3 (4)							
		(SP-SM) POORLY GRADED SAND WITH SILT; medium dense, wet, yellowish-brown, non-cemented, 15% fines (NATIVE).	SPT		3-4-6 (10)							9
15		(CL) LEAN CLAY WITH SAND; stiff, moist, brown, low plasticity, fine sand. Grades to bluish-gray.	SPT		5-4-5 (9)	1.0						
20			SPT		5-5-7 (12)							
25		Very stiff.	SPT		6-8-11 (19)							

Bottom of borehole at 26.5 feet.

CONSULTING ENGINEERS
& GEOLOGISTS

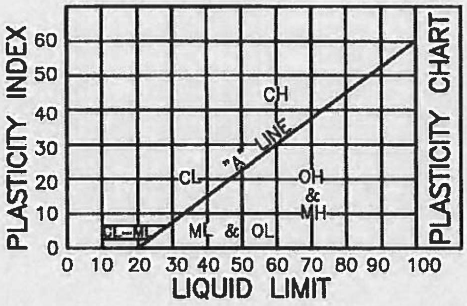
METHOD OF SOIL CLASSIFICATION

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN 1/2 OF SOIL >NO. 200 SIEVE SIZE)	**GRAVELS** (MORE THAN 1/2 OF COARSE FRACTION > NO.4 SIEVE SIZE)	GW	WELL GRADED GRAVELS OR GRAVEL–SAND MIXTURES, LITTLE OR NO FINES
		GP	POORLY GRADED GRAVELS OR GRAVEL–SAND MIXTURES, LITTLE OR NO FINES
		GM	SILTY GRAVELS, GRAVEL–SAND–SILT MIXTURES
		GC	CLAYEY GRAVELS, GRAVEL–SAND–CLAY MIXTURES
	SANDS (MORE THAN 1/2 OF COARSE FRACTION < NO.4 SIEVE SIZE)	SW	WELL GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SM	SILTY SANDS, SAND–SILT MIXTURES
		SC	CLAYEY SANDS, SAND–CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN 1/2 OF SOIL <NO. 200 SIEVE SIZE)	**SILTS & CLAYS** LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS, ORGANIC SILTS
HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZE CHART

CLASSIFICATION	U.S. STANDARD SIEVE SIZE
BOULDERS	ABOVE 12"
COBBLES	12" TO 3"
GRAVEL	3" TO NO. 4
COARSE	3" TO 3/4"
FINE	3/4" TO NO. 4
SAND	NO. 4 TO NO. 200
COARSE	NO. 4 TO NO. 10
MEDIUM	NO. 10 TO NO. 40
FINE	NO. 40 TO NO. 200
SILT & CLAY	BELOW NO. 200


PLASTICITY CHART

CONSISTENCY OF FINE GRAINED SOILS		DENSITY OF COARSE GRAINED SOILS	
CLASSIFICATION	COHESION (PSF)	CLASSIFICATION	STANDARD PENETRATION (BLOW COUNT)
VERY SOFT	0–250	VERY LOOSE	0–4
SOFT	250–500	LOOSE	4–10
MEDIUM STIFF	500–1000	MEDIUM	10–30
STIFF	1000–2000	DENSE	30–50
VERY STIFF	2000–4000	VERY DENSE	50+
HARD	4000+		

MOISTURE CLASSIFICATIONS
DRY
DAMP
MOIST
WET

BASED ON UNIFIED SOILS CLASSIFICATION SYSTEM

SHN CONSULTING ENGINEERS
& GEOLOGISTS

BORING LOG KEY

SAMPLE TYPES

☒	DISTURBED SAMPLE (BULK)
▮	HAND DRIVEN TUBE SAMPLE
I	1.4" I.D. STANDARD PENETRATION TEST SAMPLE (SPT)
◪	2.5" I.D. MODIFIED CALIFORNIA SAMPLE (SOLID WHERE RETAINED)
▯	CORE BARREL SAMPLE (NOT RETAINED)
◩	CORE BARREL SAMPLE (RETAINED)

SYMBOLS

▽	INITIAL WATER LEVEL
▼	STABILIZED WATER LEVEL
- - - - -	GRADATIONAL CONTACT
———	WELL DEFINED CONTACT
SS	SPLIT SPOON

NRCS TR-55 Curve Number Information

4

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

---

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Appendix A Hydrologic Soil Groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983).

HSG	*Soil textures*
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Drainage and group D soils

Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

Solely Pervious Runoff Calculations for Hydrologic Soil Group B

5

Solely Pervious Runoff Analysis

	Hydrologic Soil Group(a)			
	A	B	C	D
Curve Number (Good Condition)	39	61	74	80
Potential Maximum Retention After Runoff Begins (S)(b), (inches)	15.6	6.4	3.5	2.5
Initial Abstraction (I_a)(c), (inches)	3.13	1.28	0.70	0.50
Precipitation (P), (inches)	0.65	0.65	0.65	0.65

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

Bioretention Facilities O&M Plan, Bioretention Construction Specifications and Checklist

6

Bioretention Facility Operation and Maintenance Plan and Certification

Responsible Individual (RI)

The RI is the person that will have direct responsibility for the maintenance of storm water controls, maintain self-inspection records, and sign any correspondence with the California State Water Resources Control Board with project location jurisdiction. If the RI changes, this document should be updated to reflect the current RI and their current contact information.

Name of RI: Charley Batini

Phone: 707-441-2503

Project Name: Alterations to Eureka High School Albee Stadium

Site Address: 1915 J Street, Eureka, California

A site plan delineating the drainage management areas (DMA) and the location of the bioretention facilities is included in Figure 1. The final construction drawings will show the components of the facility, including elevations, gravel and soil types, plant types, and location of drainage features.

Scheduled Maintenance Activities

The following activities will need to occur on an annual basis, frequency may need to be adjusted depending on the functionality over time.

- Refuse removal: remove trash that collects near the inlets of that is trapped by vegetation. Clean out soil and debris blocking inlets or overflows.
- Control weeds: using manual methods and soil amendments as needed; pesticides should not be used.
- Add mulch: to maintain a mulch layer thickness of about 3 inches.
- Pruning and replanting vegetation: it may be necessary to replace or remove vegetation to ensure the proper functioning of the facility.
- Irrigate as necessary.

An annual self-certification letter will be mailed to the RI. This letter will serve as verification that all the storm water facilities on the property are being maintained and remain operational. The letter should be signed and returned within 30 days.

Signature and Certification

"I, the RI/applicant accept responsibility for operation and maintenance of storm water treatment and flow-control facilities until such time as this responsibility is transferred to a subsequent owner." Furthermore, a condition on the property deed will be recorded with the County Recorder's office indicating that a storm water facility is present on the property and that the maintenance responsibility will transfer with property ownership in perpetuity.

____
Name (date)

I am the:
- ☐ Property Owner
- ☒ Applicant
- ☐ Contractor

Bioretention Facility Operation and Maintenance Annual Checklist

Responsible Individual: ___________________________

Facility Name: ___________________________________

Date of Inspection: ______________________________

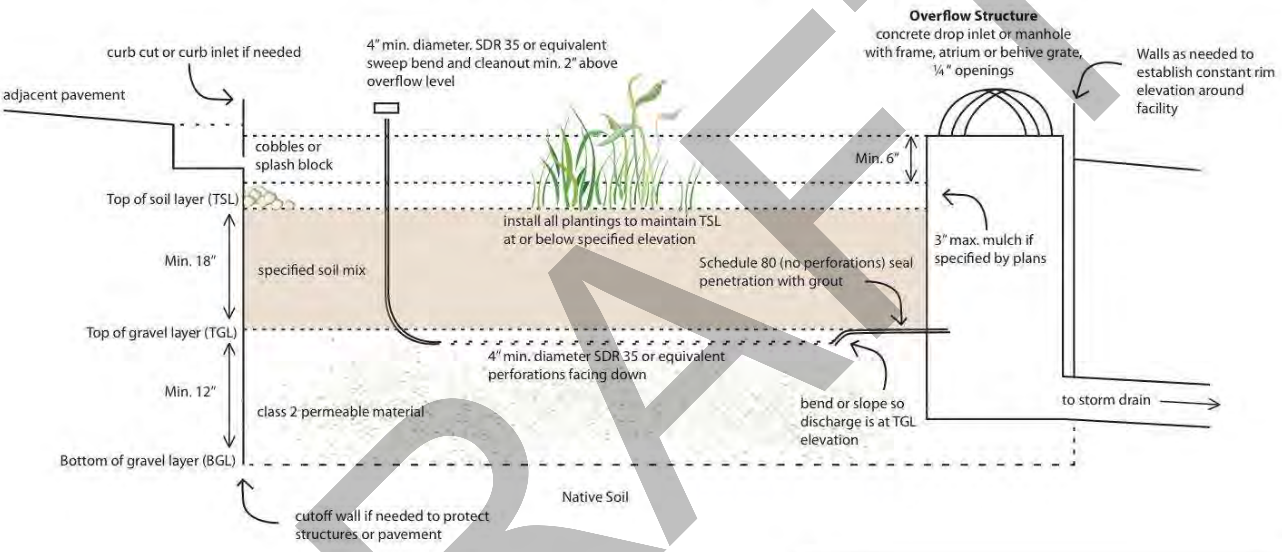
Item	Conditions when Maintenance is Needed	Maintenance Needed? (Y/N)	Type of Maintenance Completed and Date of Completion	Results Expected When maintenance is performed.
Trash and Debris	Trash and debris accumulated in basin			Trash and debris cleared from site.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants			No contaminants or pollutants present
Vegetation	When the planted vegetation becomes excessively tall. When nuisance weeds and other vegetation start to take over.			Clip vegetation. Nuisance vegetation removed so that flow is not impeded.
Erosion	Eroded over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.			Cause of erosion is managed appropriately. Areas remulched to fill in void areas.
Sediment	Accumulated sediment affects inletting or outletting condition of the facility.			Sediment removed and area reseeded if necessary to control erosion.

Item	Conditions when Maintenance is Needed	Maintenance Needed? (Y/N)	Type of Maintenance Completed and Date of Completion	Results Expected When maintenance is performed.
Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.			Pipe repaired and replaced.
Rodent Holes	Any evidence of rodent holes			Rodent control activities are in accordance with applicable laws and do not affect any protected species.

Other Notes:

Bioretention Facility

not to scale



Allowed variations for special site conditions:

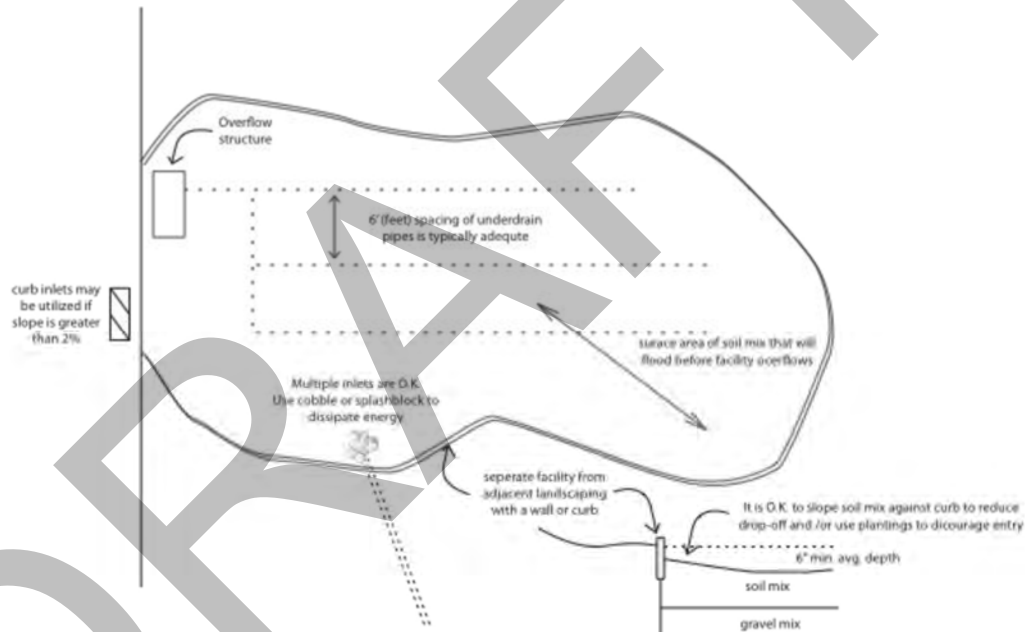
- Facilities located within 10 feet of structures or other potential geotechnical hazards may incorporate an impervious cutoff wall
- Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner between the native soil and the BGL and locate the underdrain discharge at the BGL (flow-through planter configuration)
- Facilities located in areas of high groundwater, highly infiltrative soils, or where connection of the underdrain to a surface drain or subsurface storm drain are infeasible may omit the underdrain

Notes:

- No liner, no filter fabric, no landscape cloth.
- Maintain BGL, TGL, TSL throughout facility area at elevations to be specified in plan.
- Class 7 permeable layer may extend below and underneath drop inlet.
- Elevation or underdrain discharge is at top of gravel layer.
- See Section 6.3 for instructions on facility sizing and additional specifications

Bioretention Facility - Overview

not to scale



Note:

Show all elevations of curb, pavement, inlet, top of soil layer (TSL), top of gravel layer (TGL), and bottom of gravel layer (BGL) at all inlets and outlets and at key points along edge of facility.

Soil/Compost and Gravel Specifications for Bioretention Facility

Compost shall be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids, and shall meet the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

Compost Quality Analysis:

Before delivery of the soil, the supplier shall submit a copy of the lab analysis performed by a laboratory that is enrolled in the USCC's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify that the compost parameters are within the limits specified below.

Parameter	**Range**	**Reported as (units)**
Organic Matter Content	35-75	%, dry weight basis
Carbon to Nitrogen Ratio	15:1 to 25:1	ratio
Maturity (Seed Emergence and Seedling Vigor)	>80	average % of control
Stability (CO_2 Evolution Rate)	<8	mg $C0_2$-C/g unit OM/day
Soluble Salts (Salinity)	<6.0	mmhos/cm
pH	6.5 - 8.0 May vary with plant species	units
Heavy Metals Content	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.13, tables 1 and 3.
Pathogens		
Fecal coliform	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Salmonella	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Nutrient Content (provide analysis, including):		
Total Nitrogen (N)	≥0.9	%
Boron (Total B)	<80	ppm
Calcium (Ca)	For information only	%
Sodium (Na)	For information only	%
Magnesium (Mg)	For information only	%
Sulfur (S)	For information only	%

Soil/Compost and Gravel Specifications for Bioretention Facility

Gravel Layer

The gravel layer used in the bioretention facility must consist of *Class 2 Permeable Material* as specified in the State of California's Business, Transportation and Housing Agency, Department of Transportation; Standard Specifications 2010, manual (http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpec s.pdf).

The specific section, Subsurface Drains, Sec. 68, of the manual is used because it offers specific specifications for subsurface drains. In addition to the standardized permeable layer, a membrane layer of pea gravel or other intermediate-sized material is recommended at the top of the gravel layer to prevent fines from the soil/compost layer from moving downward into the gravel layer.

68-2.02F (1) General

Permeable material for use in backfilling trenches under, around, and over underdrains must consist of hard, durable, clean sand, gravel, or crushed stone and must be free from organic material, clay balls, or other deleterious substances.

Permeable material must have a durability index of not less than 40.

68-2.02F (3) Class 2 Permeable Material

The percentage composition by weight of Class 2 permeable material in place must comply with the grading requirements shown in the following table:

Class 2 Permeable Material* Grading Requirements

Sieve sizes	Percentage passing
1"	100
3/4"	90–100
3/8"	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

*Class 2 permeable material must have a sand equivalent value of not less than 75.

Bioretention Facility Construction Checklist

Layout (to be confirmed prior to beginning excavation permit approval stage)

- ☐ Square footage of the facility meets or exceeds minimum shown in Stormwater Control Plan
- ☐ Site grading and grade breaks are consistent with the boundaries of the tributary Drainage Management Area(s) (DMAs) shown in the Stormwater Control Plan
- ☐ Inlet elevation of the facility is low enough to receive drainage from the entire tributary DMA
- ☐ Locations and elevations of overland flow or piping, including roof leaders, from impervious areas to the facility have been laid out and any conflicts resolved
- ☐ Rim elevation of the facility is laid out to be level all the way around, or elevations are consistent with a detailed cross-section showing location and height of interior dams
- ☐ Locations for vaults, utility boxes, and light standards have been identified so that they will not conflict with the facility
- ☐ Facility is protected as needed from construction-phase runoff and sediment

Excavation (to be confirmed prior to backfilling or pipe installation)

- ☐ Excavation conducted with materials and techniques to minimize compaction of soils within the facility area
- ☐ Excavation is to accurate area and depth
- ☐ Slopes or side walls protect from sloughing of native soils into the facility
- ☐ Moisture barrier, if specified, has been added to protect adjacent pavement or structures.
- ☐ Native soils at bottom of excavation are ripped or loosened to promote infiltration

Overflow or Surface Connection to Storm Drainage (to be confirmed prior to backfilling with any materials)

- ☐ Grating excludes mulch and litter (beehive or atrium-style grates recommended)
- ☐ Overflow is connected to storm drain via appropriately sized
- ☐ No knockouts or side inlets are in overflow riser
- ☐ Overflow is at specified elevation
- ☐ Overflow location selected to minimize surface flow velocity (near, but offset from, inlet recommended)
- ☐ Grating excludes mulch and litter (beehive or atrium-style grates recommended)
- ☐ Overflow is connected to storm drain via appropriately sized

Bioretention Facility Construction Checklist

Underground connection to storm drain/outlet orifice

☐ Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down

☐ Perforated pipe is connected to storm drain at specified elevation (typ. bottom of soil elevation)

☐ Cleanouts are in accessible locations and connected via sweep

Drain Rock/Subdrain (to be confirmed prior to installation of soil mix)

☐ Rock is installed as specified, 12" min. depth. Class 2 permeable, Caltrans specification 68- 2.02F(3) recommended

☐ Rock is smoothed to a consistent top elevation. Depth and top elevation are as shown in plans

☐ Slopes or side walls protect from sloughing of native soils into the facility

☐ No filter fabric is placed between the subdrain and soil mix layers

Soil Mix

☐ Soil mix is as specified.

☐ Mix installed in lifts not exceeding 12"

☐ Mix is not compacted during installation but may be thoroughly wetted to encourage consolidation

☐ Mix is smoothed to a consistent top elevation. Depth of mix (18" min.) and top elevation are as shown in plans, accounting for depth of mulch to follow and required reservoir depth

Irrigation

☐ Irrigation system is installed so it can be controlled separately from other landscaped areas

☐ Smart irrigation controllers and drip emitters are recommended and may be required by local code or ordinance.

☐ Spray heads, if any, are positioned to avoid direct spray into outlet structures

Bioretention Facility Construction Checklist

Planting

☐ Plants are installed consistent with approved planting plan, consistent with site water allowance

☐ Any trees and large shrubs are staked securely

☐ No fertilizer is added; compost tea may be used

☐ No native soil or clayey material are imported into the facility with plantings

☐ 1"-2" mulch may be applied following planting; mulch selected to avoid floating

☐ Final elevation of soil mix maintained following planting

☐ Curb openings are free of obstructions

Final Engineering Inspection

☐ Drainage Management Area(s) are free of construction sediment and landscaped areas are stabilized

☐ Inlets are installed to provide smooth entry of runoff from adjoining pavement, have sufficient reveal (drop from the adjoining pavement to the top of the mulch or soil mix, and are not blocked

☐ Inflows from roof leaders and pipes are connected and operable

☐ Temporary flow diversions are removed

☐ Rock or other energy dissipation at piped or surface inlets is adequate

☐ Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow

☐ Plantings are healthy and becoming established

☐ Irrigation is operable

☐ Facility drains rapidly; no surface ponding is evident

☐ Any accumulated construction debris, trash, or sediment is removed from facility

☐ Permanent signage is installed and is visible to site users and maintenance personnel

NRCS TR-55 Runoff Calculations

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DMA 1

Contributing Area 1	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	13,622	B	98	-
Bioretention Pervious Area (square feet)	673	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	14,295
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.53
Initial Abstraction (I_a)(c), (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.28
Runoff Volume (cubic feet)	330.0
Runoff Volume (gal)	2469

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

(d) Q= $(P-0.2S)^2/(P+0.8S)$

Contributing Area 2	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	148	B	98	-
Bioretention Pervious Area (square feet)	0	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	2,651	B	61	Good

Variable	Value
Total Area (square feet)	2,799
Composite Curve Number (CN)	63
Maximum Potential Retention After Runoff begins (S) (b), (inches)	5.87
Initial Abstraction (I_a)(c), (inches)	1.17
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.00
Runoff Volume (cubic feet)	0.0
Runoff Volume (gal)	0

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

(d) Q= $(P-0.2S)^2/(P+0.8S)$

DMA 2

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	6,410	B	98	-
Bioretention Pervious Area (square feet)	350	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	52	B	61	Good

Variable	Value
Total Area (square feet)	6,812
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.53
Initial Abstraction (I_a)(c), (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.28
Runoff Volume (cubic feet)	157.3
Runoff Volume (gal)	1176

(a) Hydrologic Soil Group
(b) S=(1000/CN)-10
(c) I_a=0.2*S
(d) Q= $(P-0.2S)^2/(P+0.8S)$

DMA 3

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	2,666	B	98	-
Bioretention Pervious Area (square feet)	153	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	2,819
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.53
Initial Abstraction (I_a)(c), (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.28
Runoff Volume (cubic feet)	65.1
Runoff Volume (gal)	487

(a) Hydrologic Soil Group

(b) $S=(1000/CN)-10$

(c) $I_a=0.2*S$

(d) $Q= (P-0.2S)^2/(P+0.8S)$

DMA 5

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	4,020	B	98	-
Bioretention Pervious Area (square feet)	240	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	4,260
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.53
Initial Abstraction (I_a)(c), (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.28
Runoff Volume (cubic feet)	98.4
Runoff Volume (gal)	736

(a) Hydrologic Soil Group
(b) S=(1000/CN)-10
(c) I_a=0.2*S
(d) $Q= (P-0.2S)^2/(P+0.8S)$

DMA 7

Contributing Area	Value	HSG[(a)]	Curve Number	Cover Condition
Impervious Area (square feet)	10,144	B	98	-
Bioretention Pervious Area (square feet)	496	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	10,640
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) [(b)], (inches)	0.53
Initial Abstraction (I_a)[(c)], (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)[(d)], (inches)	0.28
Runoff Volume (cubic feet)	245.7
Runoff Volume (gal)	1838

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

(d) $Q= (P-0.2S)^2/(P+0.8S)$

DMA 8

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	5,318	B	98	-
Bioretention Pervious Area (square feet)	400	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good
Variable				Value
Total Area (square feet)				5,718
Composite Curve Number (CN)				94
Maximum Potential Retention After Runoff begins (S) (b), (inches)				0.64
Initial Abstraction (I_a)(c), (inches)				0.13
Precipitation (P), (inches)				0.65
Runoff Depth (Q)(d), (inches)				0.24
Runoff Volume (cubic feet)				112.0
Runoff Volume (gal)				838

(a) Hydrologic Soil Group

(b) $S=(1000/CN)-10$

(c) $I_a=0.2*S$

(d) $Q= (P-0.2S)^2/(P+0.8S)$

DMA 11

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	5,712	B	98	-
Bioretention Pervious Area (square feet)	350	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	6,062
Composite Curve Number (CN)	95
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.53
Initial Abstraction (I_a)(c), (inches)	0.11
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.28
Runoff Volume (cubic feet)	140.0
Runoff Volume (gal)	1047

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

(d) Q= $(P-0.2S)^2/(P+0.8S)$

DMA 14

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	4,093	B	98	-
Bioretention Pervious Area (square feet)	459	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	4,552
Composite Curve Number (CN)	92
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.87
Initial Abstraction (I_a)(c), (inches)	0.17
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.17
Runoff Volume (cubic feet)	63.9
Runoff Volume (gal)	478

(a) Hydrologic Soil Group

(b) $S=(1000/CN)-10$

(c) $I_a=0.2*S$

(d) $Q= (P-0.2S)^2/(P+0.8S)$

DMA 15

Contributing Area	Value	HSG(a)	Curve Number	Cover Condition
Impervious Area (square feet)	7,763	B	98	-
Bioretention Pervious Area (square feet)	523	A	39	Good
Non-Bioretention Pervious Receiving Area (square feet)	0	B	61	Good

Variable	Value
Total Area (square feet)	8,286
Composite Curve Number (CN)	94
Maximum Potential Retention After Runoff begins (S) (b), (inches)	0.64
Initial Abstraction (I_a)(c), (inches)	0.13
Precipitation (P), (inches)	0.65
Runoff Depth (Q)(d), (inches)	0.24
Runoff Volume (cubic feet)	162.3
Runoff Volume (gal)	1214

(a) Hydrologic Soil Group

(b) S=(1000/CN)-10

(c) I_a=0.2*S

(d) Q= $(P-0.2S)^2/(P+0.8S)$

Site Design Measures

8

Rooftop and Impervious Area Disconnection

Description

Disconnection of rooftop and impervious areas from the storm drain system helps reduce runoff and provide pollutant removal as the re-directed water travels over and through vegetation and soil instead of being directly piped and discharged into the storm drain. Roof runoff is directed to spread over a pervious area such as a stream setback and buffers, areas of soil quality improvement, or other appropriate infiltration areas.

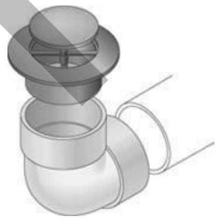
The following are examples of ways to implement rooftop disconnection:

Splash Block

Splash blocks reduce the velocity and impact of water exiting the roof downspout and direct water to a pervious area.

Pop-up Drainage Emitter

Pop-up drainage emitters are useful in conveying storm water from roof downspouts into vegetated areas. Roof runoff is piped then released through a capped device that opens with water pressure, allowing the storm water to flow out of the emitter and into the vegetated area.



Technique

On Site Plan Show:

- Delineate the impervious tributary area draining to the pervious area
- Show how the runoff will be directed to the pervious area

Confirm that the following specifications will be met:

- Tributary area (impervious area) does not exceed more than twice the pervious area
- Roof areas collect runoff and route to the suitable pervious area
- Paved areas are sloped to direct runoff to suitable pervious area
- Runoff is dispersed across the pervious area (splash block or pop-up emitter)
- Pervious area has vegetation and soils meeting the requirements of stream setbacks and buffers or areas of soil quality improvement and maintenance

Credits

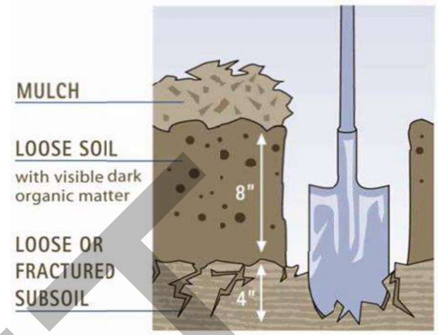
Runoff reduction credits can be applied for the area of rooftop and impervious area disconnection.

- The runoff reduction credits (square feet) will be equal to the area of rooftop and impervious area disconnection and should not exceed more than twice the pervious area receiving runoff.
- A minimum area of 150 square feet of impervious surface tributary area must apply to use this credit.

Soil Quality Improvement and Maintenance

Description

In areas subject to grading/clearing not covered by impervious surface, create/amend pervious areas with a 12" layer of topsoil. Soil quality improvement options include the following:



Technique

Option 1: Leave native vegetation and soil undisturbed and protect from compaction during construction

Identify areas of the site that will not be stripped, logged, graded, or driven on, and fence off those areas to prevent impacts during construction. If neither soils nor vegetation are disturbed, these areas do not require amendment.

Option 2: Amend existing site topsoil or subsoil

Scarify or till subgrade to 8 inch depth (or to depth needed to achieve a total depth of 12 inches of un- compacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Amend soil to meet desired organic content.

Option 3: Stockpile existing topsoil during grading. Replace topsoil before planting.

Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission. Replace stockpiled topsoil prior to planting and ensure that replaced soil plus additional compost as needed will amount to at least 12 inches of depth.

Compost/amendment shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter.

Credits

Runoff reduction credits can be applied for the area of soil quality improvement.

- The runoff reduction credits (square feet) will be equal to the area of soil quality improvement.
- A minimum area of 150 square feet of soil quality improvement area must apply to use this credit.

Humboldt LID Stormwater Manual
Hydromodification Guidelines

9

1.0 APPLICABILITY

The following table provides an overview of the various project types and required submittals for projects within the boundaries of the County of Humboldt's MS4 permit area and the cities of Arcata, Eureka, Fortuna, and Trinidad, which are subject to the MS4 General Permit. An MS4 General Permit Boundary Map is attached and can also be obtained from the County or City Department with project location jurisdiction. The requirements for stormwater management are determined by the type and scale of the project.

Table 1 - Applicable Post-Construction Standards Based on Project Type

Type of Project	**Required Submittals:**
Exempt Projects Exempt Projects include: • Projects that create or replace less than (<) 2,500 square feet (SF) of impervious surface; • Interior remodels and routine maintenance or repair such as exterior wall surface replacement; • Reroofing of an existing building; • Asphalt or paving overlays and resurfacing of existing surfaces. "Replacement, Development, or Redevelopment" is defined as work that replaces existing surfaces down to subgrade and are not exempt; and • Linear Underground Projects (LUPs) unless the LUP has a discreet location that has greater than or equal to (≥) 5,000 SF of newly constructed impervious surface	• Stormwater Information Sheet
Small Projects Small Projects include: • Single-Family Homes, not part of a larger plan of development, that create or replace greater than or equal to (≥) 2,500 SF of impervious surface; and • Projects that create or replace greater than or equal to (≥) 2,500 SF and less than (<) 5,000 SF of impervious surface	• Stormwater Information Sheet • Follow instructions in Part B of this manual. • Small Project Stormwater Control Plan (SCP)
Regulated Projects Regulated Projects include: • Projects other than *Single -Family Homes* that create or replace greater than or equal to (≥) 5,000 SF of impervious surface.	• Stormwater Information Sheet • Follow instructions in Part C of this manual. • Preliminary SCP (discretionary projects) • Final SCP (all regulated projects)
Regulated Redevelopment, Roads, and Linear Underground Projects Regulated Redevelopment, Roads, and Linear Underground Projects include: • See MS4 Permit, Section E.12.c (pg. 50) for additional description and details of applicable Redevelopment, Road, and Linear Underground project requirements.	• Requirements vary; contact County or City department with project jurisdiction.
Hydromodification Projects: Hydromodification projects are: • Specific Regulated Projects, projects that create and/or replace greater than or equal to (≥) 1 acre of impervious surface and create a net increase in impervious surface. • A project that does not increase impervious surface area over the pre-project condition is not a hydromodification management project (MS4 permit Sec. E.12.f). • Projects with greater than or equal to (>) 1 acre of Land Surface Disturbance may be subject to the State Construction General Permit (CGP) Post-Construction Standards and shall comply with the Humboldt LID Stormwater Manual, Regulated Project Post-Construction Standards in lieu of CGP Post-Construction Standards, if project location falls within the MS4 General Permit areas.	• Requirement is: post-project runoff shall not exceed estimated pre-project flow rate for the 2-year, 24-hour storm. • See regulated projects above • Follow instructions in Part C of this manual

Definition of Impervious Surface: A surface covering or pavement of a developed parcel of land that prevents the land's natural ability to absorb and infiltrate rainfall/stormwater. Impervious surfaces include, but are not limited to: roof tops, walkways, patios, driveways, parking lots, storage areas, impervious concrete and asphalt, and any other continuous watertight pavement or covering. Landscaped soil and pervious pavement, including pavers with pervious openings and seams, underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold the specified volume of rainfall runoff, are not impervious surfaces.

Definition of Land Surface Disturbing Activities: Any construction or demolition activity, including, but not limited to: clearing of vegetation, grading, grubbing, and disturbance to the ground such as stripping of top soils, soil compaction, excavation, and stockpiling or any other activity that results in a land disturbance that changes the physical condition of land forms, soils, vegetation, and hydrology.

5.8 Hydromodification (if required)

Hydromodification projects are Regulated Projects creating and/or replacing one acre or more of impervious surface that create a net increase in impervious surface. The required performance standard for hydromodification control consists of maintaining post-project runoff at or below pre-project flow rates for the 2-year, 24-hour storm event.

Compliance with this standard can be met through the use of self-retaining areas (as referenced in Section 6.1.1 Types of Drainage Management Areas). However, soil infiltration rates on site must be taken into account, using *ASTM D 422 standard test method for particle-size analysis of soils*, when using self-retaining areas to meet the hydromodification design storm requirement.

2-year, 24-hour storm (NOAA, 2014):
- Humboldt Bay MS4 Areas, 2.93 inches
- Shelter Cove MS4 Area, 4.11 inches

Sites with infiltration rates less than (<) 1.0 inch per hour do not meet the hydromodification requirements using the self-retaining ratio method; alternatives to the self-retaining area will need to be discussed with the jurisdictional permitting authority.

Follow the chart below to determine the steps necessary for using the self-retaining area to comply with the hydromodification design storm requirements.

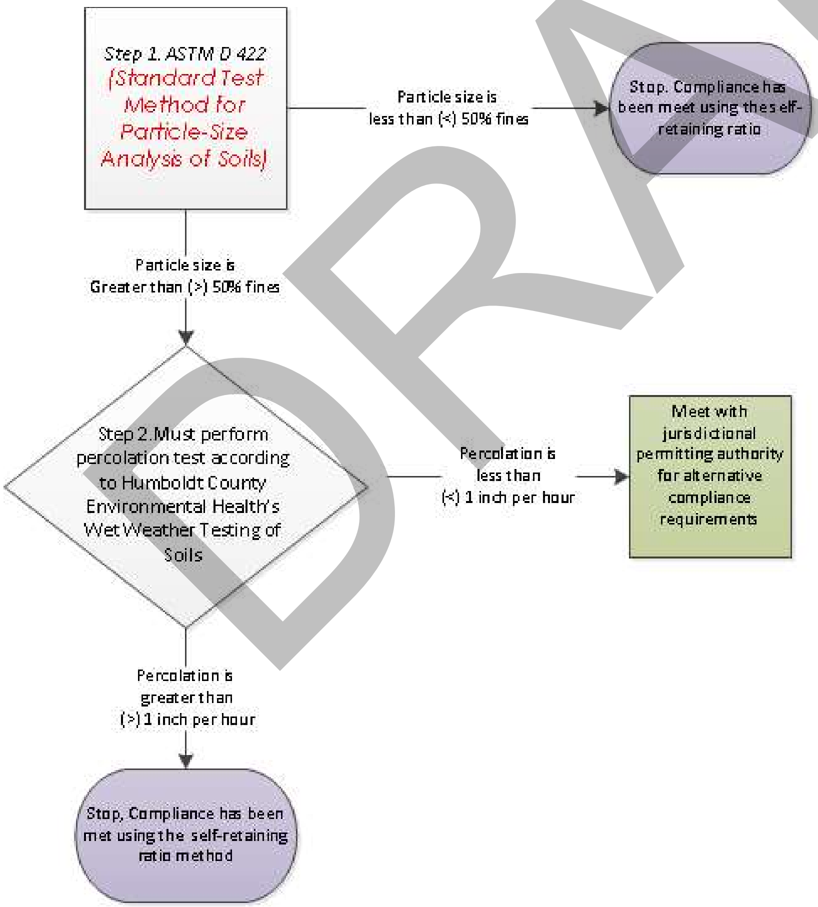


Figure 3. Procedure for Documenting Compliance with Hydromodification Requirements

facilities or equivalent. The DMA tributary area to the bioretention facility will then be multiplied by a sizing factor of 0.04; this is performed to calculate the minimum footprint of the bioretention facility, assuming that all design specifications outlined in this manual are followed.

> A sizing factor of 0.04 (facility can treat up to 25 times the size of the facility footprint) is used, in conjunction with the other specifications for a bioretention facility (soil/compost infiltration rate (5”/hour), reservoir depth, gravel layer depth, etc…), because these specifications meet the specific requirements in the MS4 permit [E.12.e. ii (f)]

After computing the minimum bioretention facility size, review the site plan to determine if the reserved space for the facility is sufficient. If the area is not sufficient, revise plan accordingly.

6.3.1 Bioretention Facility Design

Bioretention facilities can be a variety of shapes. However, each of the layers within the facility must be designed and built flat and level. The following must have consistent elevations throughout:

- Bottom of excavation/ gravel layer (BGL)
- Top of gravel storage layer (TGL)
- Top of soil layer (TSL)
- Rim of facility reservoir

The surface reservoir should be level and circumscribed by a ridged boundary such as a concrete curb, masonry, or landscape timbers.

6.3.1.1 Gravel Layer

The gravel layer must be a “Class 2” open graded substrate: Caltrans specification 68-2.02F(3) is recommended. Drain rock or other granular material may be used. The depth of the gravel layer must be at least 12 inches. It must also be equivalent in area to the surface area of the facility (Appendix 4).

6.3.1.2 Planting Medium

A mixture of sand (60%-70%) and compost (30%-40%) should be used. The mixture must meet the following requirements: have the ability to sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project; sand mixture must meet the specifications of American Society for Testing and Materials (ASTM) C33. The specific compost and sand combination which meets the above requirements is found in Appendix 4.

6.3.1.3 Underdrain

When using an underdrain, a PVC pipe diameter of 4 inches must be used, SDC 35 or equivalent. A perforated pipe, installed with perforations facing down, should be embedded into the TGL. The connection with the storm drain must not be lower than the TGL. A threaded, capped cleanout connected by a sweep bend should be used. For a more detailed diagram of the requirements, see Appendix 4.

6.3.1.4 Plantings and Mulch

Select an appropriate plant palette or similar for the bioretention facility from Appendix 5.

Hydromodification Calculations

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Time of Concentration (NRCS - Velocity Method, TR-55)

Project: Eureka High School Albee Stadium
Project # 020116

Development Condition:	***Pre-Development***	
Design Event:	2 year storm	

Sheet Flow

Slope (S)	0.24	(ft/ft)
Manning's Roughness (n)	0.15	(for shallow sheet flow grass)
P_2 (2yr, 24hr)	2.93	in
Max Length (L)	30	ft

Travel Time:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

T_t = 0.024 hr

Shallow Concentrated Flow

Velocity (L) (fig 15-4)	0	ft/s
Length (L)	0	ft

Travel Time :

$$T_t = \frac{L}{3{,}600\ V}$$

T_t = 0.000 hr

Open Channel Flow 1: Concrete Valley Gutter

Slope (S)	0.01	ft/ft
Manning's Roughness (n)	0.013	(for channel flow)
Cross Section Flow Area (a)	0.056	sqft
Wetted Perimeter (P_w)	1.34	ft
Hydraulic Radius (r), r=a/P_w	0.042	ft
Length (L)	122	ft

$$V = \frac{1.49r^{2/3}s^{1/2}}{n} \quad \Rightarrow V = 1.38 \quad \text{ft/s}$$

$$T_t = \frac{L}{3{,}600\ V}$$

Tt = 0.025 hr

Open Channel Flow 2: 12" Storm Drain

Slope (S)	0.02	ft/ft
Manning's Roughness (n)	0.013	(for channel flow)
Cross Section Flow Area (a)	0.393	sqft
Wetted Perimeter (P_w)	1.57	ft
Hydraulic Radius (r), r=a/P_w	0.250	ft
Length (L)	167	ft

$$V = \frac{1.49r^{2/3}s^{1/2}}{n} \quad \Rightarrow V = 6.43 \quad \text{ft/s}$$

$$T_t = \frac{L}{3{,}600\ V}$$

Tt = 0.007 hr

Open Channel Flow 3: 30" Concrete SD

Slope (S)	0.013	ft/ft
Manning's Roughness (n)	0.013	(for channel flow)
Cross Section Flow Area (a)	2.138	sqft
Wetted Perimeter (P_w)	3.67	ft
Hydraulic Radius (r), r=a/P_w	0.583	ft
Length (L)	798	ft

$$V = \frac{1.49r^{2/3}s^{1/2}}{n} \quad \Rightarrow V = 9.12 \quad \text{ft/s}$$

$$T_t = \frac{L}{3{,}600\ V}$$

Tt = 0.024 hr

Time of Concentration

Sheet Flow Tt =	1.45	min
Shallow Concentrated Tt =	0.00	min
Open Channel Flow, VG, Tt =	1.47	min
Open Channel Flow, 12", Tt =	0.43	min
Open Channel Flow, 30", Tt=	1.46	min

Time of Concentration = 4.81 min

Time of Concentration (NRCS - Velocity Method, TR-55)

Project: Eureka High School Albee Stadium
Project # 020116

Development Condition:	***Post-Development***	
Design Event:	2 year storm	

Sheet Flow

Slope (S)	0.005	(ft/ft)
Manning's Roughness (n)	0.011	(for shallow sheet flow conc)
P_2 (2yr, 24hr)	2.93	in
Max Length (L)	230	ft

Travel Time:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

T_t = 0.072 hr

Shallow Concentrated Flow

Velocity (L) (fig 15-4)	0	ft/s
Length (L)	0	ft

Travel Time :

$$T_t = \frac{L}{3{,}600\ V}$$

T_t = 0.000 hr

Open Channel Flow 1: 12" PVC Storm Drain

Slope (S)	0.02	ft/ft
Manning's Roughness (n)	0.01	(for channel flow)
Cross Section Flow Area (a)	0.393	sqft
Wetted Perimeter (P_w)	1.57	ft
Hydraulic Radius (r), r=a/P_w	0.250	ft
Length (L)	48	ft

$$V = \frac{1.49r^{2/3}s^{1/2}}{n} \quad => V = 8.36 \quad \text{ft/s}$$

$$T_t = \frac{L}{3{,}600\ V}$$

Tt = 0.002 hr

Open Channel Flow 2: 28" PVC SD

Slope (S)	0.013	ft/ft
Manning's Roughness (n)	0.01	(for channel flow)
Cross Section Flow Area (a)	2.138	sqft
Wetted Perimeter (P_w)	3.67	ft
Hydraulic Radius (r), r=a/P_w	0.583	ft
Length (L)	567	ft

$$V = \frac{1.49r^{2/3}s^{1/2}}{n} \quad => V = 11.86 \quad \text{ft/s}$$

$$T_t = \frac{L}{3{,}600\ V}$$

Tt = 0.013 hr

Time of Concentration

Sheet Flow Tt =	4.29	min
Shallow Concentrated Tt =	0.00	min
Open Channel Flow, 12", Tt =	0.10	min
Open Channel Flow, 30", Tt=	0.80	min

Time of Concentration = 5.19 min

Composite Curve Number (CN), TR-55

Project: Eureka High School Albee Stadium
Project # 020116

Composite Curve Number (CN) Pre-Development

Hydrologic Soil Group	Cover Description	Table 2-2	Figure 2-3	Figure 2-4	Area (acres)	Product of CN x Area
Silt Loam, B	Open Space, Good Condition	61			1.082	66
Silt Loam, B	Impervious Area, Pavement, Roof	98			2.995	294
Silt Loam, B	Gravel Road	85			0.088	7
				Totals	4.165	367

Pre-Development Composite CN = 88

Composite Curve Number (CN) Post-Development

Hydrologic Soil Group	Cover Description	Table 2-2	Figure 2-3	Figure 2-4	Area (acres)	Product of CN x Area
Silt Loam, B	Open Space, Good Condition	61			0.480	29
Silt Loam, B	Impervious Area, Pavement, Roof	98			3.550	348
Silt Loam, B	Gravel Road	85			0.051	4
Bioretention Infiltration, A	Open Space, Good Condition	39			0.084	3
				Totals	4.165	385

Post-Development Composite CN = 92

Peak Discharge - SCS Curve Number/Graphical Method (NRCS TR-55)

Project: Eureka High School Albee Stadium
Project # 020116

Design Event: 2yr Storm

Pre-Development

Runoff (Q)

24hr Rainfall (P) - 2yr Storm	2.93	in	
Curve Number (CN)	88		Composite CN
Max Retention After Runoff Begins (S)	1.36	in	
Runoff: Q = (P-0.2S)^2/(P+0.8S)	**1.76**	**in**	

Peak Discharge (q_p): $q_p = q_u A_m Q F_p$

Initial Abstraction (I_a)	0.273	in	(Table 4-1)
Rainfall Distribution Type	IA		(Fig B-2)
I_a/P	0.09		
Time of Concentration	0.10	hrs	
q_u	163	csm/in	(Exhibit 4-IA)
Area (A_m)	0.0065	mi^2	
Pond/Swamp Factor (F_p)	1.0		

q_p = 1.86 cfs

Post-Development

Runoff (Q)

24hr Rainfall (P) - 2yr Storm	2.93	in	
Curve Number (CN)	92		Composite CN
Max Retention After Runoff Begins (S)	0.87	in	
Runoff: Q = (P-0.2S)^2/(P+0.8S)	**2.10**	**in**	

Peak Discharge (q_p) - $q_p = q_u A_m Q F_p$

Initial Abstraction (I_a)	0.174	in	(Table 4-1)
Rainfall Distribution Type	IA		(Fig B-2)
I_a/P	0.06		
Time of Concentration	0.10	hrs	
q_u	163	csm/in	(Exhibit 4-IA)
Area (A_m)	0.0065	mi^2	
Pond/Swamp Factor (F_p)	1.0		

q_p = 2.22 cfs

Hydromodification (2-year, 24-hour Storm)
Post Development Peak Flow Mitigation

Pre-Development Peak Runoff	1.86	cfs	
Post-Development Peak Runoff (without mitigation)	2.22	cfs	
Bioretention Basin Infiltration Unit Rate	5	in/hr	Humboldt LID Manual
Bioretention Basin Area (entire site)	3,644	SF	
Total Site Bioretention Basin Infiltration Rate	0.42	cfs	
Post Development Peak Runoff (with mitigation)	**1.80**	**cfs**	

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Eureka, CA | Arcata, CA | Redding, CA | Willits, CA | Fort Bragg, CA | Coos Bay, OR | Klamath Falls, OR