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Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

MEMORANDUM

TO:	Scott Smithwick, DEVCON Construction Virginia Calkins, SRGNC	DATE:	August 15, 2019
FROM:	Caitlin Gilmore, PE Chuck Anderson, PE	JOB#:	GOOG.03.18
SUBJECT:	Dewatering Plan for the Google West Channel Enhancement		

The following conceptual dewatering plan was developed based on the draft 50% Design Development (DD) plan set dated June 29, 2018 and is intended to be used as an internal document to support environmental permit applications. This draft plan does not consider construction scheduling with the adjacent Santa Clara Valley Water District (District) West Channel Flood Control Project nor does it consider the development of the Google properties 100 and 200 Caribbean adjacent to the channel enhancement project reach.

Objectives

- Temporarily divert water from the project reach of Sunnyvale West Channel from upstream of the project to downstream of Caribbean Drive, a total length of approximately 1,300 feet.
- Create a dewatered work area and facilitate construction by dewatering the entire length of the channel within the project site.
- Prevent erosion, sedimentation and siltation from occurring in the upstream or downstream channel reach under active construction.

Design Event

The anticipated channel flow during construction is 1.4 cubic feet per second (cfs) which is the likely average flow in West Channel during the construction period from April 15th to October 15th with a maximum flow of 12 cfs. This is based on an upstream drainage area of 2.87 square miles and a flow of 0.5 cfs per square mile in urban areas drained by gravity based on the approximate pumping needed from the urbanized City of Milpitas storm drainage systems. There is no natural upstream watershed to the Sunnyvale West urbanized channel system.

There are no storm drainage outfalls within the project reach.

Schedule

The dewatering system will be in place and functioning prior to the start of in-channel construction work and will be removed only after all construction work at a dewatered reach is complete with a maximum duration of 6 months. The contractor may dewater the project areas in phases or all at once. The construction period will be during the dry season from April 15th to October 15th 2019.

Installation of the dewatering system will take approximately one week, and will commence at an allowed start date per the regulatory approvals. After construction activities at a reach are completed, the AquaDam and earthen coffer dams and diversion system will be removed within 48 hours. Flows will be

restored to the new construction reach in a manner that minimizes erosion. Ponded water will be re-directed into the established low-flow channel in a gradual manner to avoid an erosive surge of water.

The dewatering and system removal schedule will be coordinated with the upstream and downstream District project as well as the onsite construction.

Description of Dewatering System

System Overview

The dewatering system will be composed of an AquaDam spanning the full width of the channel located at the downstream boundary of the construction reach (i.e. just downstream of Caribbean Drive bridge — see Location A in *Appendix A*) and an earthen coffer dam spanning the full width of the channel located at the upstream limits of the construction reach (i.e. upstream of the Caspian Drive Bridge — see Location B in *Appendix A*); 28-inch diameter fused high-density polyethylene (HDPE) pipes (or multiple pipes of the same carrying capacity) to convey the diverted water around the construction reach; and riprap or equivalent erosion protection for the system discharge point (i.e. energy flow dissipater—see Table 1 BMPs below).

AquaDam Coffer Dam

A plastic water filled AquaDam will be inflated to a height of 9 feet from the existing downstream invert of the Caribbean bridge culvert and set at a minimum of elevation 7.4 feet NAVD88 (see Tidal Influences below) to prevent the intrusion of tidal water upstream from the coffer dam. The coffer dam must not exhibit UV corrosion for the duration of their installation. The cofferdam must be installed per manufacturer's instruction. Contractor will provide shoring behind the AquaDam as needed (see Detail 2 in *Appendix B*).

Earthen Coffer Dam

Earthen coffer dam will constructed using a combination of gravel-filled sandbags and sheet plastic with a minimum thickness of 6 mil. The gravel fill for the sandbags will contain no more than 15% fines. The gravel-filled sandbags will be placed on top of the plastic material, which will be laid above the invert for the 28-inch HDPE pipe. The width of the invert must be enough to wrap the installed sandbags in a "burrito-wrap" configuration. The sandbags will stack in a staggered pyramid-like fashion (see Detail 1 in *Appendix B*). After the design height has been reached, the original sheet plastic shall be placed on top of the sandbags and secured with additional sand bags. Sandbags on top of the sheet plastic will be spaced no more than 3 feet apart. To maximize flow inflow through the 28-inch HDPE pipe, the upstream configuration of the coffer dam will have a funnel shape with the portions closest to the channel banks wider than the mid-channel portion of the coffer dam. The top of the dam will be lowest in height at the center of the dam and increase in height towards the banks, thereby directing overtopping water into the centerline of the channel. See *Appendix E (to be included in final version)* for coffer dam height calculations.

Pipe System

The pipe system will be composed of a 28-inch diameter fused HDPE pipe trunk line, or two smaller pipes with equivalent capacity. The system will use gravity to convey water impounded by the upstream coffer dam and water collected from storm drain outlets to the low flow channel below the lower coffer dam. The bypass system can be located either to the east or west of the channel. If gravity flow is not effective in conveying water due to tidal influence, pumps will be used as necessary. Riprap (1/4 to 1/2 ton) will be placed at the downstream discharge point of the HDPE pipe to prevent erosion of the channel

bed. If necessary, one or more check dams, composed of straw/hale bales secured by wooden stakes (straw/hale bales) would be installed to slowly reduce water velocities and prevent bed erosion.

Energy Flow Dissipater

Diversion pipe flow energy (velocity) dissipater will be installed downstream of the AquaDam coffer dam on existing channel invert and banks. Pipe discharges will occur from low to high tide, and outlets shall be located above Mean Higher High Water. Dissipater may be under tide water and shall be designed to resist degradation by tidal movement. Dissipater shall be installed from pipe outlet to channel invert. Design shall be in accordance with CASQA Construction BMP EC-10 (see *Appendix C*).

Groundwater

All construction work will be implemented under dewatered channel conditions. If groundwater seepage occurs within the dewatered reach, pumps will be used to discharge the seepage flows to intakes of the 28-inch HDPE trunk line. When discharging into the intakes of the 28-inch pipe, the top opening of the intake will be sealed.

Tidal Influences

The maximum water surface elevation (WSEL) for the mean higher high water (MHHW) is approximately 7.4 feet NAVD88 (Schaaf & Wheeler, Draft West Channel Enhancement for Google Hydraulic Basis of Design). This tidal influence WSEL is at the mouth of Guadalupe Slough. The downstream AquaDam coffer dam would be set at elevation 7.4 feet NAVD88 to prevent the intrusion of tidal water upstream from the coffer dam. Since tidal waters can potentially reduce the flows downstream or even back up the flows upstream, pumps will be on standby to transfer excess flows downstream of the coffer dam.

System Removal

Once the construction work is completed at a dewatered reach, the diversion system and coffer dams will be removed within 48 hours of completion. Removal of the diversion pipe will start at the downstream terminus of the system and proceed upstream. Flows will be restored within the new construction area in a manner that minimizes erosion. Ponded flows will be re-directed into the established low-flow channel. Flows will be gradually restored to the channel to avoid a potentially erosive surge of water. All equipment and materials used in the dewatering system will be removed from the channel for re-use or proper disposal.

Water Quality Monitoring

The dewatering contractor will be responsible for visual observations, collection of water samples, and transportation of samples in a timely manner to an accredited laboratory testing. Water samples will be collected from the channel 100’ above and below the dewatered zone and from the HDPE pipe system within the dewatered zone. The HDPE pipe system will include air vents at maximum intervals of 500 feet in to allow collection of water samples from the pipes. During normal operation, the air vents will remain closed; the vents will be opened to obtain water sample. A section of clear pipe shall be installed on groundwater pump discharges to monitor turbidity.

Water quality testing will commence two days prior to installation of the dewatering system and will continue until one day after the dewatering system is completely removed. Observations, testing and sampling will be performed for the parameters listed in Table 1. Water quality readings will be submitted as part of daily QA/QC reports.

Table 1 – Water Quality Testing Parameters

Parameter	Frequency of Sampling/Testing	Exceedance Limit
Turbidity	Twice Daily	Incremental increase by 5 NTUs if background <50 NTUs and 10 percent if background >=50 NTUs
pH	Twice Daily	>0.5 units deviation above or below ambient levels
Dissolved Oxygen	Twice Daily	Minimum of 5.0 mg/l or no change if background <5.0mg/l
Temperature	Twice Daily	Increase by more than 5 degrees Fahrenheit above natural temperatures
Floating matter, foam, alteration of color, visible oil or other petroleum products	Daily	Visual observations only

Daily is defined as each day is which construction work occurs in the channel reach. Typically, this will be Monday through Friday except for holidays. If any construction occurs on a Saturday, Sunday or holiday, water quality monitoring will occur on that day also.

If water quality testing parameters are exceeded, the contractor will immediately investigate the potential source of the problem. The contractor shall at a minimum pump effluent from dewatered areas to baker tanks for settling prior to discharge to the 28-in HDPE pipe if turbidity is exceeded. If the contractor's operations are causing the problem, then the issue will be corrected immediately.

If the source is outside of/beyond the project limits, the contractor will notify the Water District, who will then notify the regulatory agencies of the situation, so that the regulatory agencies can determine the proper response to the water quality issue.

Best Management Practices

Applicable BMPs

The design and operation of the West Channel dewatering system will conform to the applicable SCVWD BMPs to prevent adverse impacts to water quality. Table 2 lists the applicable BMPs as detailed in *Appendix D (to be included in final version)*.

Table 2 – Water Quality BMPs Applicable to West Channel Enhancement Dewatering System

BMP No.	Title
WQ-1	Limit Impact of Pump and Generator Operation and Maintenance
WQ-2	Limit Impacts of Sediments on Water Quality
WQ-3	Limit Impacts from Staging and Stockpiling Materials
WQ-4	Stabilize Construction Entrances and Exits
WQ-5	Limit Impact of Concrete Near Waterways
WQ-6	Isolate Work in Tidal Areas with Use of Coffer Dam
WQ-7	Use Seeding for Erosion Control, Weed Suppression and Site Improvement
WQ-8	Manage Exposed Groundwater at Work Sites
WQ-9	Maintain Clean Conditions at Work Sites

BMP No.	Title
WQ-10	Control Sediment/Turbidity from Discharges
WQ-11	Prevent Water Pollution
WQ-12	Prevent Stormwater Pollution

Contingency Plans

Storm Event

It is unlikely, but possible, that a dry season precipitation event or high tide event could be of sufficient magnitude to exceed the design capacity of the dewatering system. To prevent damage to the system and adverse environmental impacts, the contractor will adhere to the requirements in Table 3.

If the volume of water impounded at the upstream coffer dam or tide levels at the downstream coffer dam exceeds the capacity of the dewatering system, the excess water will be pumped into baker tanks for temporary storage and proper disposal.

Table 3 – Dry Season Contingency Plan

Event	Response
>30% likelihood of significant precipitation	Inspect all BMPs and remedy identified deficiencies
>50% likelihood of significant precipitation or tides above MHHW	Maintain baker tanks and pumps at dewatering site and collect excess water as required
Precipitation causes violation of water quality standard	All construction operations cease until applicable water quality parameter is met

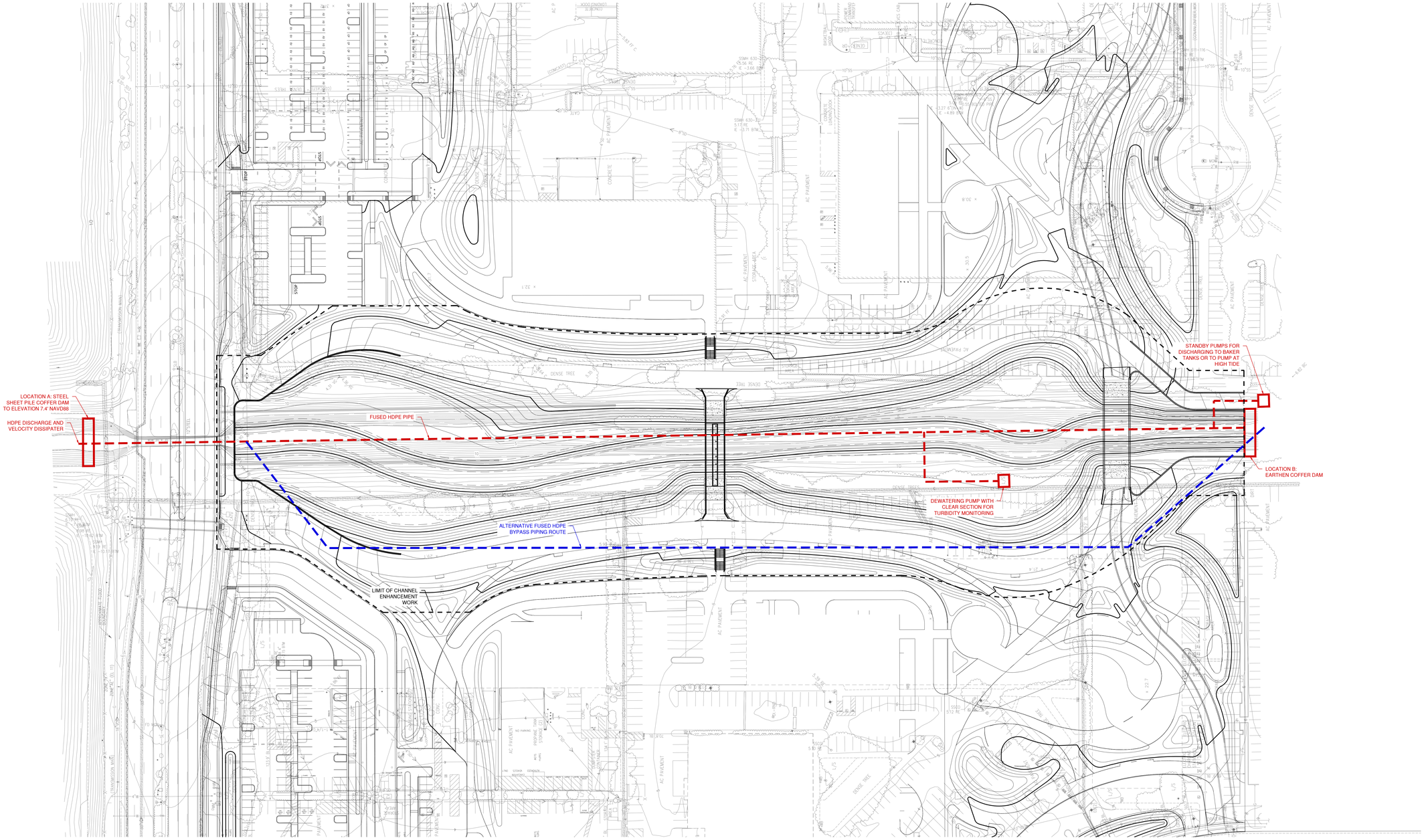
System Failure

The dewatering system could fail due to mechanical problems or unusually heavy flows exceeding the design flow. As a contingency, spare pipe materials, fittings, and pumps will be stored on site to facilitate timely repairs of damaged parts, thereby ensuring that the systems have a high degree of reliability and operability. In addition, additional pumps and baker tanks will be maintained on site. Excess flows will be filtered through the baker tanks and appropriately discharged downstream of the active reach.

In the case of actual or incipient system failure, the contractor will immediately perform all practical actions to remove sources of pollutants associated with the construction effort from the channel or prevent their entrainment by water flowing in the channel. This includes removing equipment and vehicles from the channel and protecting material stockpiles from in-channel flows.

Appendices

- Appendix A – Site Plans
- Appendix B – Coffer Dam Details
- Appendix C – Velocity Dissipation Detail
- Appendix D – BMPs (to be included in final)
- Appendix E – Coffer Dam Calculations (to be included in final)



DEWATERING PLAN

SCALE: 1" = 40'

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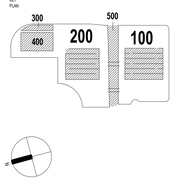
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NOT FOR CONSTRUCTION

KEY PLAN



SHEET NAME

DEWATERING PLAN

PROJECT NO
11-185
CSW ID

SCALE
1" = 40'

ISSUE
ADDENDUM H

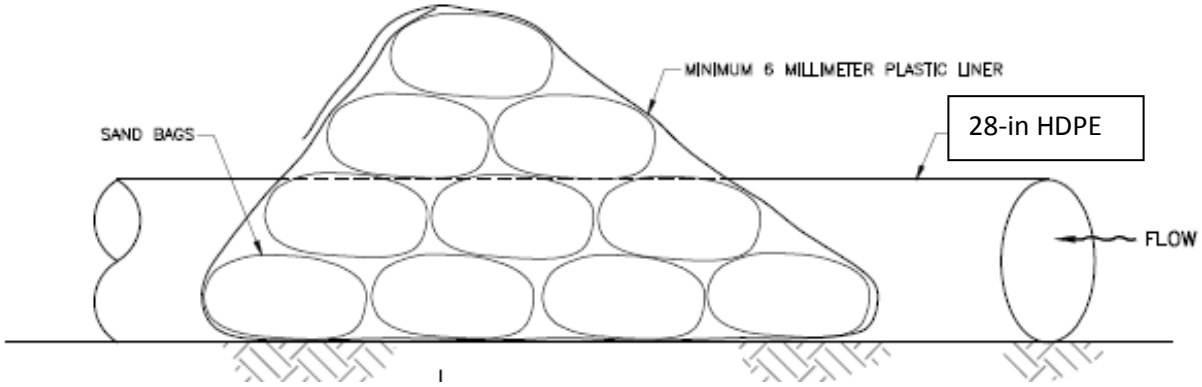
DATE
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SHEET NO

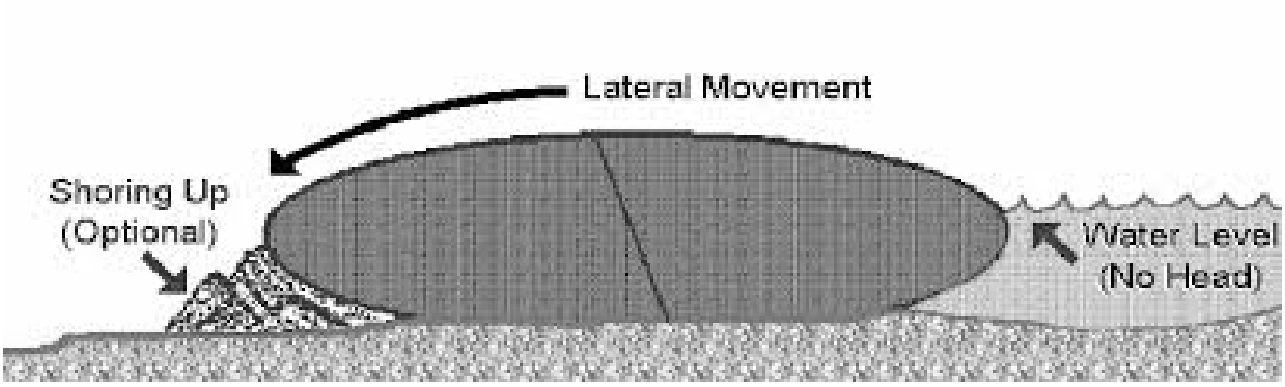
APPENDIX A

CPRA CONFIDENTIAL TREATMENT REQUEST
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PRE-OCCSIONAL DRAFT FOR REVIEW ONLY

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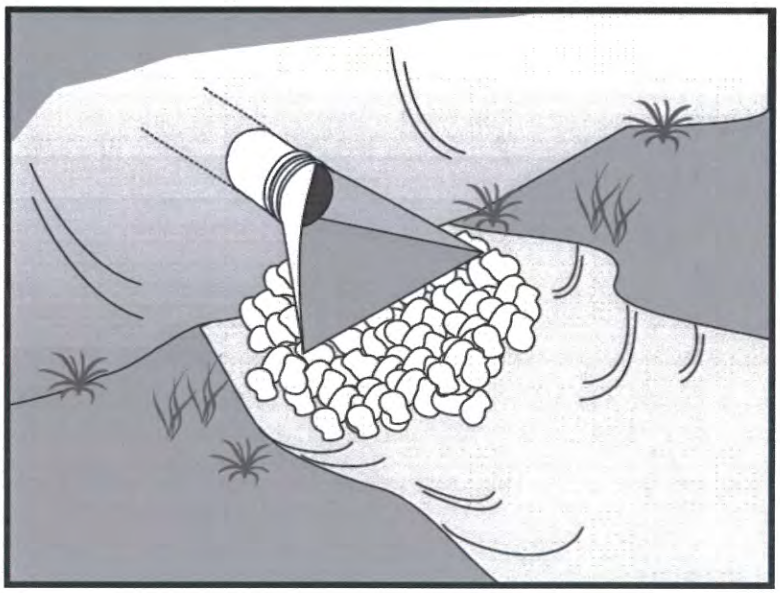
Detail 1 – Typical Earthen Coffer Dam (N.T.S)



Detail 2 – Typical AquaDam Coffer Dam (N.T.S)

Appendix C

Velocity Dissipation Devices EC-10



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

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CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.
    - Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
    - Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- For proper operation of apron: Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

References

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Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

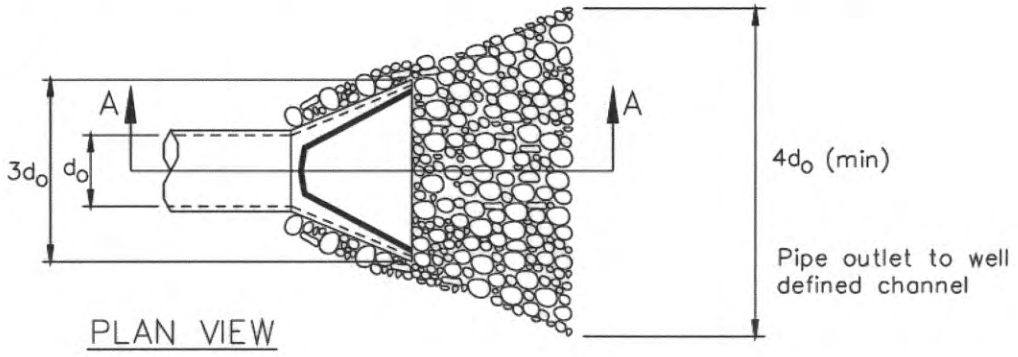
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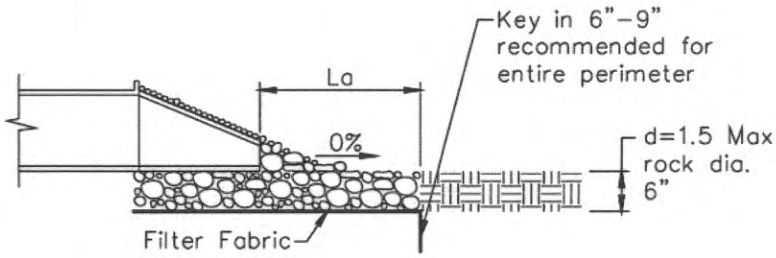
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PLAN VIEW

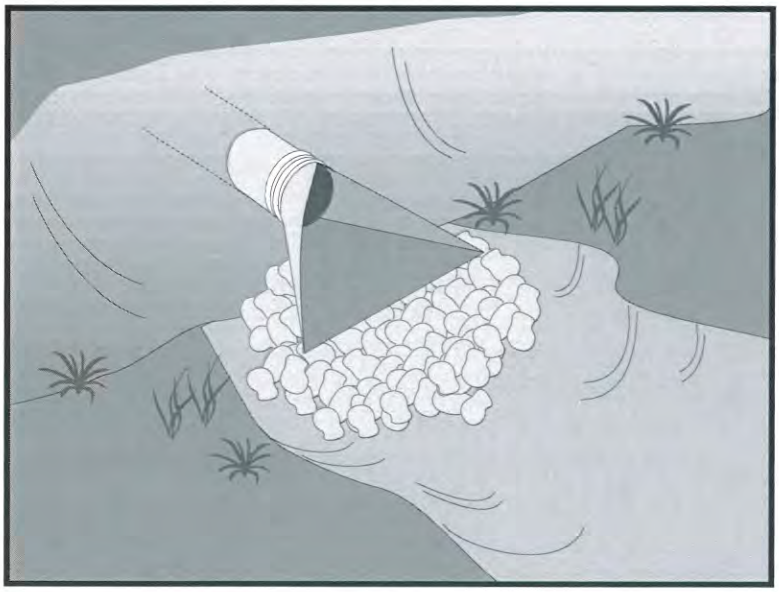


SECTION A–A

Pipe Diameter inches	Discharge ft³/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS

Velocity Dissipation Devices EC-10



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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Description and Purpose

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  - Points where lined conveyances discharge to unlined conveyances

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in velocity dissipation devices.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

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- Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
- Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.
- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- For proper operation of apron: Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.
- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.
- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.
- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

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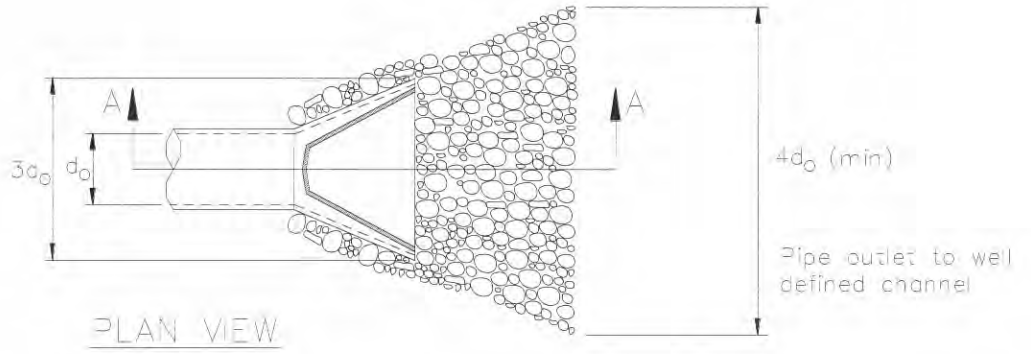
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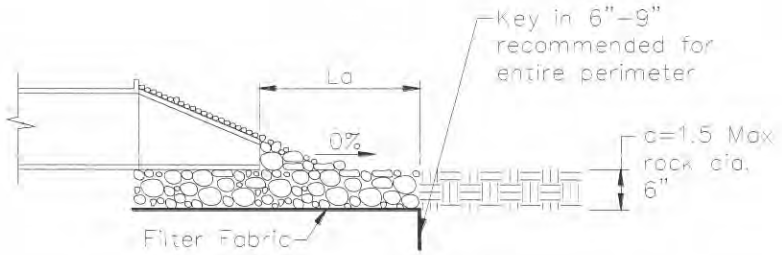
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PLAN VIEW



SECTION A–A

Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS