APPENDIX E

Hydrology and Drainage Reports

Prepared by

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October and December 2008

RAK CIVIL ENGINEERS
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HYDROLOGY/HYDRAULICS REVIEW
For
Wal-Mart Store #2697 Expansion
Williamson Ranch Plaza, Antioch, CA

Introduction

This review is being prepared for the proposed development of the Wal-Mart Supercenter Expansion located at the Williamson Ranch Plaza Retail Center in Antioch, CA. The purpose is to investigate the existing and proposed storm drainage conditions as well as the associated impacts of the expansion project. This report is intended as an update to the Hydrology/Hydraulics Review prepared for the Williamson Ranch Plaza in September 2005.

Site Location

The proposed development is located in the southeast region of the City of Antioch, Contra Costa County, California. The project site encompasses a 3.7-acre undeveloped portion of the larger 21.6-acre Wal-Mart site, the majority of which is developed and occupied by a Wal-Mart Division 1 store. The Wal-Mart site is a portion an overall 33-acre retail development, known as Williamson Ranch Plaza Phase I, located at the northwest quadrant of the intersection of Lone Tree Way and Hillcrest Drive. The site is bounded by an existing flood control canal to the north (East Antioch Creek), the existing phase II of the Williamson Ranch Plaza to the west, Lone Tree Way to the south, and Hillcrest Avenue to the east. The general surrounding area is largely residential, with existing subdivisions to the south across Lone Tree Way and north/northeast across the flood control canal.

Existing Conditions

The first phase of the Wal-Mart project developed approximately 17.9 acres of the 21.6-acre site. The on-site storm drainage system was designed to accommodate the post-development runoff from the 10-year storm event. The storm drainpipes in proximity to the undeveloped 3.7-acres were stubbed and capped for future extension. Under current conditions, the majority of the undeveloped 3.7-acre expansion area is not served by a storm drain system. Most site runoff either percolates into the soil, or temporarily ponds until it evaporates, or it flows directly to the adjacent channel of East Antioch Creek. Some of the runoff in the eastern portion of the expansion area enters two temporary field inlets, which were installed with the construction of the existing Wal-Mart store. Refer to the attached Hydrology Map for the location of the existing storm drainage system.

Under existing conditions for a 100-year storm event, the overall Wal-Mart site of 21.6 acres has a flow rate of 24.62 cfs, which accounts for the 17.9-acre developed impervious area and the 3.7-acre undeveloped Wal-Mart expansion area.

Proposed Conditions

The estimated peak flow rate of the fully developed site for a 100-year storm was previously calculated to be **28.35 cfs**. This was based on the Rational Hydrology Method and $Q=CiA$, where Q is the flow rate in cubic feet per second, C is the runoff coefficient, i is the rainfall intensity, and A is the site area in acres. Parameters for the calculation are consistent with the City of Antioch and Contra Costa County Public Works Department for on-site private development flow rate requirements. (It should be noted that this post-development runoff figure was based on the larger 22.5-acre Wal-Mart site which existed in 1998, and that was subsequently reduced by 0.9 acres through a lot line adjustment with the adjacent parcel to the west.)

The expansion project would cover most of the 3.7-acre expansion area with impervious surfaces. This would increase the peak runoff rate by about 3.73 cfs. Development of the expansion area would increase the overall runoff rate for the 21.6-acre Wal-Mart site from 24.62 cfs to 28.35 cfs during a 100-year storm event. This runoff rate of 28.35 cfs is the same as the overall runoff rate calculated by Robert A. Karn & Associates for the entire 22.5-acre site in 1998. (Although the site plan for the expansion area has been modified, the extent of impervious surface coverage resulting from the currently planned Wal-Mart expansion would be about the same as originally planned. As noted above, the overall site area is 0.9 acres smaller than considered in the original runoff analysis.)

Drainage Improvements

1. On-Site - The expansion project would include the following drainage improvements:

   - Installation of five drop inlet catch basins
   - Removal of four drop inlet catch basins
   - Conversion of one drop inlet to a junction box
   - Construction of five stormwater treatment devices
   - Installation of 6" subdrains as part of the stormwater treatment devices
   - Installation of 15" and 24" stormdrains
   - Each watershed that is part of the expansion project is graded to drain to a stormwater treatment device

   Refer to the Hydrology Map for locations of the drainage improvements.

2. Off-Site - There are no off-site drainage facilities proposed for this project.

In accordance with City of Antioch and Contra Costa County Public Works standards, the on-site storm drain system for the expansion area will be designed using a 10-year storm event, with parameters in the grading design for a 100-year overland drainage release. For the purposes of this review, the 100-year storm event is used to quantify the amount of potential storm runoff,

which would enter the public system, by combining the overland release and the underground storm system network. The East Antioch Creek flood control channel was sized and designed to accommodate the post-development storm runoff and flood flows generated at the project site, including the expansion area. Therefore, the Wal-Mart expansion project will not result in drainage impacts or increased downstream flooding potential.

Stormwater Compliance

As authorized by the Clean Water Act, the **National Pollutant Discharge Elimination System** (NPDES) permit program controls water pollution by regulating sources that discharge pollutants into waters of the United States. The City's discharge of Stormwater is covered under the NPDES program and requires the City to have a municipal Stormwater permit.

There are 4 creeks, which wind through the city: East Antioch Creek, Markley Creek (a tributary of West Antioch Creek), Sand Creek, and West Antioch Creek. Within the city limits are also parts of the watersheds for Marsh Creek and Kirker Creek. These creeks receive runoff from neighborhoods through a system of storm drains or through rain filtration and runoff of permeable surfaces. All water that runs down the City's streets and into the storm drains flows into the local creeks and eventually to the San Joaquin River.

The City of Antioch's NPDES program is charged with the responsibility of preventing pollution and maintaining the storm water system. They have adopted the Contra Costa Clean Water Program, which requires developments to provide for pre- and post- construction treatment of storm water run-off.

The California Regional Water Quality Control Boards for the San Francisco Bay Region and Central Valley Region (RWQCBs) have mandated that Contra Costa municipalities impose new, more stringent requirements to control runoff from development projects. The RWQCBs amended Provision C.3 of the municipalities' Stormwater NPDES permit in February 2003. The municipalities have phased in the requirements from 2004 through 2006. The RWQCBs determined that the new Provision C.3 requirements are needed to implement Federal Clean Water Act provisions governing discharges to municipal storm drains. Congress adopted amendments to the Clean Water Act in 1987, and the United States Environmental Protection Agency (USEPA) issued implementing regulations in 1990. The San Francisco Bay RWQCB began issuing Stormwater discharge permits to municipalities that same year. Since the early 1990s, Contra Costa municipalities have required contractors to implement temporary Best Management Practices (BMPs) to minimize the amount of sediment and other pollutants that enter site runoff during construction. For several years, the municipalities have also encouraged applicants to design their projects to minimize new impervious area and to incorporate into their plans permanent treatment BMPs – features and devices that detain, retain, or treat runoff for the life of the project. As before, the standard for these BMPs is "maximum extent practicable," or MEP. However, the new permit requirements define MEP more specifically and include design criteria. The new development provisions are one part of a comprehensive Stormwater pollution prevention program implemented by each Contra Costa municipality.

Those programs also require:

1. Controls on runoff from existing commercial and industrial sites.

2. Temporary measures to control sediment and other pollutants in runoff from construction sites.

3. Changes in the way the municipalities maintain streets, parks and public infrastructure.

4. Prevention of illegal dumping in storm drains.

5. Public outreach and education.

For previously undeveloped sites, and for project applications "deemed complete" after February 15, 2005, the C.3 requirements apply if a project creates one acre or more impervious area. On August 15, 2006, this threshold was reduced to 10,000 square feet of impervious area. For sites that have been previously developed, the threshold is more complex. If the new project results in an increase of, or replacement of, 50% or more of the previously existing impervious surface, and the existing development was not subject to Stormwater treatment measures, then the entire project must be included in the treatment measure design. **If less than 50% of the previously impervious surface is to be affected, only that portion must be included in the treatment measure design.** Interior remodels, routine maintenance or repair, roof or exterior surface replacement, and repaving are not subject to C.3 requirements.

This project is developing 18% of the previous impervious area, or 3.71 acres of the total 21.6-acre site. Therefore, the new C3 guidelines will only apply to the 3.71 acres of proposed impervious surface.

NPDES permit Provision C.3.d includes criteria for designing treatment BMPs. These criteria target treatment of 80% of average annual runoff. Because a large portion of average annual runoff is produced by small storms that occur many times a year, treatment BMPs can be designed to bypass larger storms. The 80% criterion means that BMPs will be bypassed, on average, every 1-2 years. Because treatment BMPs are designed to treat only small storms, they can be considerably smaller than detention basins designed to protect property during flood-generating storms that may recur in 10%, 4%, or 1% of coming years. However, treatment BMPs must be designed as part of an overall drainage system that can accommodate larger storms.

Proposed Mitigation

The proposed development does not have a significant impact on the existing storm drain system as designed and provided by the Contra Costa County Flood Control and Water Conservation District and City of Antioch. Stormwater run-off will be directed to treatment devices designed in accordance with the Contra Costa Clean Water Program Stormwater C.3 Guidebook – third edition October 2006 and then conveyed off-site via the proposed underground storm drainage system, which will be designed with sufficient capacity to accommodate increased flows from the project. No off-site mitigation is required as part of this project.

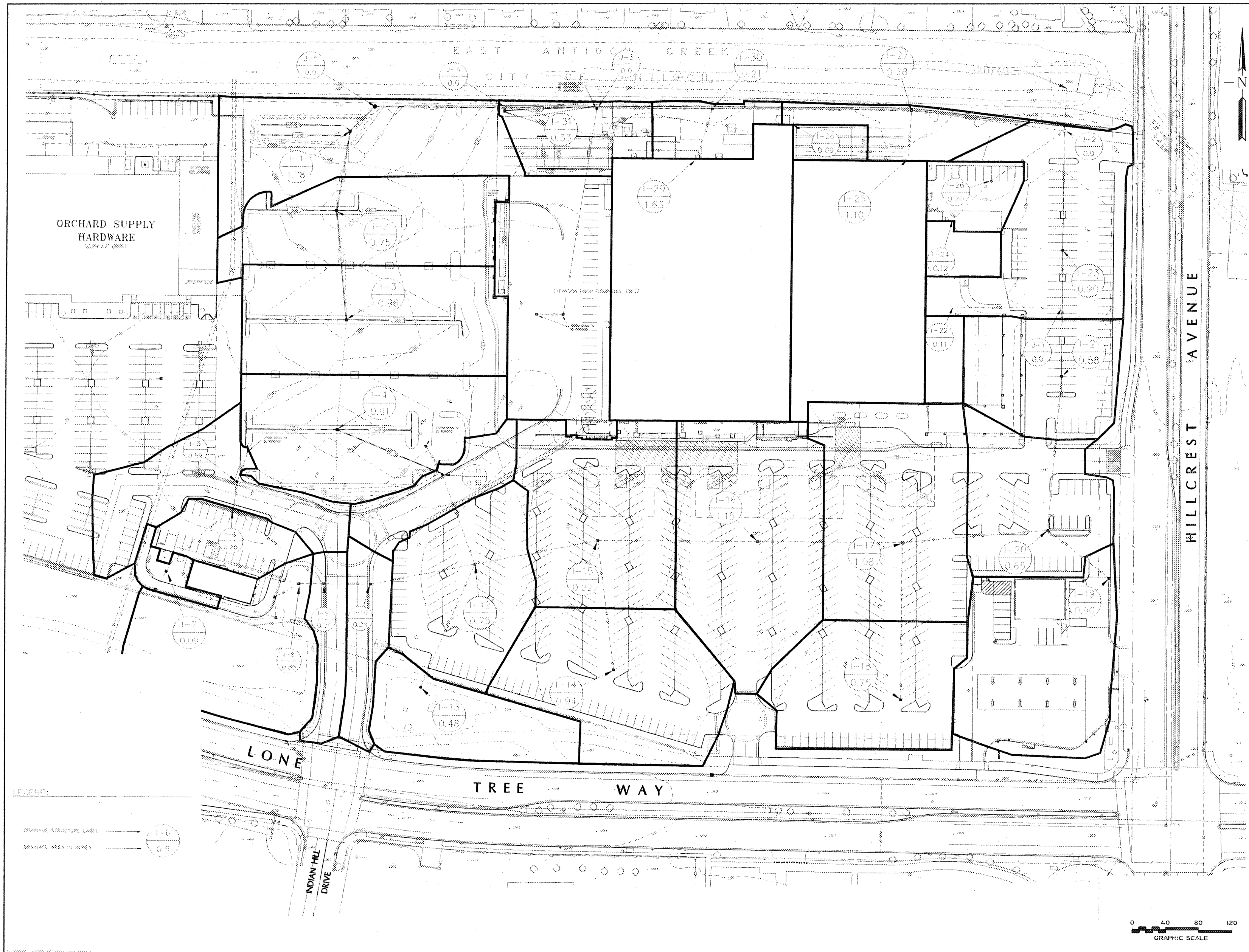
State, City and agency requirements, which will require proper design, construction and maintenance procedures, will be implemented as part of this development. The project sponsor and its affiliated consultants will provide the following standards and procedures as required by the City of Antioch.

1. Obtain all necessary permits for construction activities involving storm water improvements; i.e., NPDES, State and Regional Water Quality, EBMUD, CCFCWCD, City of Antioch and others as may be required as part of the review process.

2. Provide proper erosion control and silt control measures for construction activities, which will commence during October 15th to April 15th of each year.

3. Provide for treatment of on-site storm run-off through implementation of source control BMPs, stormwater treatment devices and/or other measures, as required by the City of Antioch to comply with the intent of the Contra Costa Clean Water Program Stormwater C.3 Guidebook – third edition October 2006.

APPENDIX A – HYDROLOGY MAP



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HYDROLOGY MAP
WAL-MART STORE 2697 EXPANSION
CITY OF ANTIOCH, CALIFORNIA
FOR: WAL-MART STORES INC.

C5A

A03048

Stormwater Control Plan

WAL-MART
STORE #2697 EXPANSION
4893 Lone Tree Way
Antioch, CA, 94509

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I. Project Setting

A. Projection Description and Information Summary

The proposed development is located in the southeast region of the City of Antioch, Contra Costa County, California (Figure 1). The project site encompasses 6.3-acres, which is a portion an overall 33-acre retail development located at the northwest quadrant of the intersection of Lone Tree Way and Hillcrest Drive. The site is bounded by an existing flood control canal to the north (East Antioch Creek), an Orchard Supply Hardware store to the west, existing phase II of the Williamson Ranch Plaza, Lone Tree Way to the south and Hillcrest Drive to the east. The general area is largely residential in use, with existing subdivisions to the south across Lone Tree Way and north/northeast across the flood control canal.

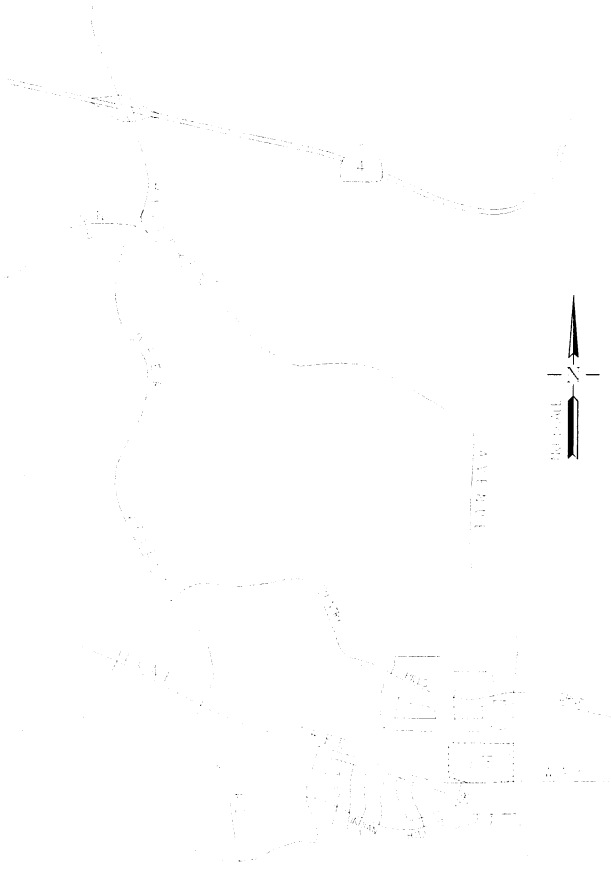


Figure 1. Vicinity Map

B. Existing Site Conditions

The first phase of the Wal-Mart project constructed was approximately 17.9 acres. The interior storm drainage system pipe sizing was designed to accommodate the post-development runoff from the 10-year storm event. Storm drainpipes were stubbed and

capped for future extension. Under current conditions, the majority of the undeveloped 6.3-acre expansion area is not served by a storm drain system. Most site runoff either percolates into the soil, or temporarily ponds until it evaporates, or it flows directly to the adjacent channel of East Antioch Creek. Some of the runoff in the eastern portion of the expansion area enters two temporary field inlets, which were installed with the construction of the existing Wal-Mart store. The elevation of site is approximately 130 feet above mean sea level. The general topography of the area proposed for building pad was relatively level. The existing zoning for this project site is commercial.

A geotechnical exploration of the site was performed by The Twining Laboratories, Inc. The report dated January 22, 1998 (Project Number: A80920.01-01) indicates no active surface faults in the site vicinity. The soils encountered consist of near surface medium stiff lean and fat clays with interbedded stiff sandy silt layers (NRCS Hydrological Soil Group "D"). The laboratory tests indicate that the clays exhibit a low to medium expansive potential, moderate to high plasticity, moderate shear strength and moderate compressibility characteristics. This type of soil has a low infiltration rate.

Groundwater was encountered between the depths of 7 to 12.5 feet in the fifteen boring test drilled to the depth between 10 and 41.5 feet below site grade.

C. Opportunities and Constraints for Stormwater Control

Treatment and flow control of runoff from the site are to be provided.

Planned landscaped areas include landscape setbacks along East Antioch Creek and within the parking islands.

Discharge of runoff to deep filtration is not feasible on this site due to the low permeability of the clay soils (soil group D).

Constraints include:

- A 10' wide easement for an 8" water line runs parallel to and 20 feet inside the site's northern boundary.
- A 10' wide easement for an 8" water line runs parallel to site's eastern boundary.
- A 10' wide easement for a 6" water line runs from site's eastern to southern boundary.
- A 10' wide water easement runs across from site's eastern to western boundary.
- A 15' wide easement for a 30" existing storm drain runs parallel to site's western boundary.
- A 15' wide easement for a 24" existing storm drain runs from site's eastern to southern boundary.
- A 15' wide easement for a sanitary sewer runs from site's western to southern boundary.

In addition, as part of the building expansion, the front entrance along the south side of the building will be modified to be in compliance with current ADA standards. To meet those standards, the pavement and parking islands in that location are being modified. These modifications will result in a net increase of pervious area. To address treatment to the maximum extent possible, these pervious areas will be made self-retaining. Additional efforts to treat the remaining impervious areas are impracticable.

An inventory of the existing and proposed pervious areas that are located within the area being modified to be compliant with current ADA standards is tabulated below in Table 1. Refer to the Preliminary Stormwater Control Plan Exhibit for the location of the existing and proposed pervious areas.

Table 1. Existing and Proposed Pervious Areas

Existing Pervious Area		Proposed Pervious Area	
Area ID	Size (sq.ft.)	Area ID	Size (sq.ft.)
AREA 1	295	SR-17	174
AREA 2	222	SR-18	173
AREA 3	222	SR-19	130
AREA 4	222	SR-20	174
AREA 5	222	SR-21	174
AREA 6	320	SR-22	183
AREA 7	222	SR-23	429
AREA 8	222	SR-24	174
AREA 9	444	SR-25	183
		SR-26	174
		SR-27	199
		SR-28	174
		SR-29	221
		SR-30	502
		SR-31	96
		SR-32	324
Total	2,391	Total	3,484

II. Measures to Limit Imperviousness

A. Measures to Cluster Development and Protect Natural Resources

The following site layout characteristics are incorporated to reduce imperviousness:

- The site is developed to maximum density.
- The parking lots serving the building are to be landscaped with in-ground planter boxes or self-retaining areas.

B. Measures to Limit Directly Connected Impervious Area

1. Site Design Features

   Impervious areas (roofs, pavement, etc.) are disconnected from the drainage system. To the maximum extent possible, runoff from these impervious areas is directed to treatment and flow control BMPs.

2. Pervious Pavements

   Conventional concrete and conventional asphalt are used throughout the site. Permeable pavements, although feasible, are somewhat impractical for this site because of heavy vehicle use and because pavements overlie nearly impermeable, expansive clay soils.

3. Detention and Drainage Design

   The flow control requirements to manage increases in runoff peak flows and durations (hydrograph modification management) are satisfied by demonstrating compliance under option 2 from the flow control standard taken from the CCCWP Stormwater C.3 Guidebook, 3rd edition.

   Stormwater runoff from the building roof and parking lot will be conveyed to treatment and flow control BMPs.

   Each BMP has adequate hydraulic head to allow drainage into, through, and away from the BMP without the need of pumps.

C. Summary of Pervious Areas

Pervious areas in this project are located throughout the site. All of these pervious areas are designed to be standard landscaping, self-treating, self-retaining or Integrated Management Practice BMPs.

Self-retaining areas will be graded in a concave form to ensure that the first one-inch of rainfall on the area will be retained before any runoff can occur.

Self-treating areas will be graded to drain directly off site or to a storm drain system.

Refer to Table 3 and Table 4 of the Appendix for a list and size of self-treating and self-retaining areas. The locations are shown on the Stormwater Control Plan Exhibit.

III. Selection and Preliminary Design of Storm Water BMPs

Requirements to manage increases in runoff peak flows and durations (hydrograph modification management) are satisfied by compliance under option 2 from the flow control standard taken from the CCCWP Stormwater C.3 Guidebook, 3rd edition.

Impervious areas on site, including all roofs, parking areas, and driveways, have been divided into 17 drainage management areas (12 paved, 5 roof) as shown on the Stormwater Control Plan Exhibit.

Runoff from these areas is managed by routing to an in-ground planter or a bioretention area sized to treat runoff from that area.

All IMPs located on the site have suitable access for inspection and maintenance.

The Stormwater Control Plan Exhibit shows the IMPs and the corresponding roof and paved areas that drain to each IMP. The areas of each drainage management area (DMA) and corresponding IMP are listed in Table 5 thru Table 9 of the Appendix

Several impervious areas will not drain to an IMP for treatment. These areas include DMA PAVE-6, PAVE-11, and PAVE-12. PAVE-6 is located at the north side of project site along East Antioch Creek. This DMA is located between the proposed and existing pavement and cannot be drained toward planter PL-4 due to grading constraints. PAVE-11 is a small pavement section located at the southeast corner of the project site. PAVE-12 is a section of sidewalk along the southern section of the project site. The untreated stormwater from these DMA accounts for less than 1% of the total project area.

Drainage management areas ROOF-4, ROOF-5, PAVE-7, PAVE-8, PAVE-9, and PAVE-10 are also untreated. Refer to section I.C. for further explanation.

A. General Characteristics

1. In-Ground Planters

   In general, in-ground planters are configured as shown in Appendix C of the *Stormwater C.3 Guidebook, Third Edition*. All planters feature a minimum 18" depth of sandy loam (minimum infiltration rate specified to be 5" per hour.) All planters are underdrained (Soil groups C and D), and the underdrains are connected to underground storm drains that carry the treated runoff as well as any overflow off-site. All drainage into and away from the BMPs is by gravity, eliminating the need to collect and pump stormwater and avoiding the need for vaults.

   The physical configuration of the planters, including inlets and outlets, varies. Details are shown in cross section on the Stormwater Control Plan Exhibit.

2. Bioretention Areas

   In general, bioretention areas are configured as shown in Appendix C of the *Stormwater C.3 Guidebook, Third Edition*. All bioretention area feature a minimum 18" depth of sandy loam (minimum infiltration rate specified to be 5" per hour.) All bioretention areas are underdrained (Soil groups C and D), and the underdrains are connected to underground storm drains that carry the treated runoff as well as any overflow off-site. All drainage into and away from the BMPs is by gravity, eliminating the need to collect and pump stormwater and avoiding the need for vaults. Gravel layer must be 48 inches deep. Planting must be suitable to imported sandy loam soil, the site, and location. Plantings will be selected to minimize potential future need for fertilizers or pesticides.

B. Specific Characteristics of Each Impervious Area and IMP

Specific descriptions of each drainage management area (DMA) and IMP are located in Table 5 thru Table 9 of the Appendix.

IV. Source Control Measures

The following activities planned for the Antioch Wal-Mart expansion have the potential to allow pollutants to enter runoff:

- Landscape maintenance.
- Food services and future retail tenants that provide food service.
- Refuse disposal.
- Loading and unloading.

To further reduce the potential for pollutants to enter runoff, permanent and operational source control BMPs will be implemented as described in Table 2.

Table 2. Source and Source Control BMPs

Potential Source of Runoff Pollutants	Permanent Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	Mark inlets that could be easily accessed with a "No Dumping-Drains to Creek" or similar message.	• Maintain and periodically repaint or replace inlet markings. • Lessees will receive stormwater pollution prevention information to be provided by the City. • Tenant leases will include clause stating: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Interior floor drains and elevator shaft sump pumps	State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	• Inspect and maintain drains to prevent blockages and overflow.
Need for future indoor and structural pest control	Standard building design minimizes potential needs for future pest control.	Lessees will receive integrated pest management information to be provided by the City.

Potential Source of Runoff Pollutants	Permanent Source Control BMPs	Operational Source Control BMPs
Landscape/outdoor pesticide use	• Any native trees, shrubs, and ground cover on the site will be preserved to the maximum extent possible. • Landscaping will be designed to minimize required irrigation and runoff, to promote surface infiltration, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. • Plantings for swales will be selected to be appropriate to anticipated soil and moisture conditions. • Where possible, pest resistant plants will be selected, especially for locations adjacent to hardscape. • Plants will be selected appropriate to site soils, slopes, climates, sun, wind rain, land use, air movement, ecological consistency, and plant interactions.	• Lessees and new site owners will receive integrated pest management information. • All site landscaping is to be maintained by a professional landscaping contractor. Contract to state that landscaping is to be maintained using IMP principles, with minimal or no use of pesticides.
Food service	All facilities approved for food service uses will be required to have an interior mop sink suitably sized for washing any floor mats, containers, or equipment per City use permit requirements.	Provide "Water Pollution Prevention Tips to Protect Water Quality and Keep Your Food Service Facility Clean" brochure to new site owners and lessees.
Refuse areas	• Refuse areas outside to be roofed and burbed. Any drains must connect to sanitary sewer. • Other refuse areas to be indoors and floors sloped to prevent drainage to exterior. Any floor drains must connect to sanitary sewer. • All dumpsters will be marked with a "Do Not Dump Hazardous Materials Here" or similar.	• Adequate litter receptacles will be provided throughout the commercial area. • Grounds keeping crew or contractor will inspect and clean up daily. • Spills will be cleaned up using dry methods.
Loading areas	The loading/unloading area drains to a IMP or treatment device rather than directly to storm drain.	Unloading materials (except for outdoor display) will be moved indoors or under cover as quickly as practicable.

Potential Source of Runoff Pollutants	Permanent Source Control BMPs	Operational Source Control BMPs
Fire sprinkler test water	Fire sprinkler test valves will be equipped with a means to divert test water to the sanitary sewer.	
Miscellaneous drain or wash water • Boiler drain lines • Condensate drain lines • Rooftop equipment • Drainage sumps • Roofing, gutters, and trim	• Boiler drain lines shall be directed or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. • Condensate drain lines will discharge to the sanitary system or to landscaped areas. • Rooftop mounted equipment will be roofed or covered to prevent pollutants from entering runoff. • Drainage sumps shall feature a sediment sump to reduce the quantity of sediment in pumped water. • Roofing, gutters and trim shall not be copper or other unprotected metal that could leach into runoff.	
Plazas, sidewalks, and parking lots		Plaza, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Wash water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

V. Permitting and Code Compliance Issues

There are no known conflicts between the proposed storm water control plan and the City of Antioch ordinances or policies. Any conflicts that are found will be resolved through the design review process or during subsequent permitting.

VI. BMP Operations and Maintenance

A. Means to Finance and Implement BMP Maintenance

All storm water treatment facilities in this plan will be owned and maintained in perpetuity by the private owner of the subject property. The applicant accepts responsibility for interim operation and maintenance of the facilities until such time as this responsibility is formally transferred to a subsequent owner.

If the City of Antioch should require, the applicant will execute, prior to completion of project construction, a Stormwater Facilities Operation and Management Agreement per the model proposed by the Contra Costa Clean Water Program. Such an agreement will "run with the land" and be enforceable on subsequent property owners.

The applicant will submit, with the application for building permits, a draft Stormwater Facilities Operation and Maintenance Plan including detailed maintenance requirements and a maintenance schedule.

1. Commitment to Execute any Necessary Agreements

   Wal-Mart, agrees to provide any necessary easements or right of entry to Contra Costa County for access and inspection of stormwater BMPs.

2. Statement of Responsibility for Operation and Maintenance of Facility

   Wal-Mart, agrees to maintain the BMPs which will be designed for this project until one of the following occurs: (1) Acceptance of maintenance responsibility by the City, including the filling of all required easements and establishment of a special district or other permanent funding mechanism or (2) Other private entity to be responsible for maintenance, execution of codes, Covenants, and Responsibilities or other agreement that run with the land and requires future owners to provide and pay for maintenance of stormwater BMPs, and execution of a stormwater management facilities Operation and Maintenance Agreement and right of Entry in the form provided by the City.

B. Summary of Maintenance Requirements

1. Bioretention Areas

These facilities remove pollutants primarily by filtering runoff slowly through an active layer of soil. Routine maintenance is needed to insure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active. Typical maintenance consists of the following:

- Inspect inlets, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment. Examine rock or other material used as a splash pad and replenish if necessary.
- Inspect outlets for erosion or plugging.
- Inspect side slopes for evidence of instability or erosion and correct as necessary.
- Observe soil at the bottom of the swale or bioretention area for uniform percolation throughout. If portions of the swale or bioretention area do not drain within 48 hours after the end of the storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment.
- Confirm that check dams and flow spreaders are in place and level and that channelization within the swales or filter is effectively prevented.

- Examine the vegetation to insure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. Confirm that irrigation is adequate and not excessive. Replace dead plants and remove invasive vegetation.
- Abate any potential vectors by filling in the ground and around swale and by insulating that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the County Vector Control District for information and advice. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.

2. Infiltration Planters

Planter boxes capture runoff from downspouts or sheet flow from plazas and paved areas. The runoff briefly floods the surface of the box and then percolates through an active soil layer to drain rock below. Typical maintenance consists of the following:

- Examine downspouts from rooftops or sheet flow from paving to ensure that flow to the planter is unimpeded. Remove any debris and repair any damaged pipes. Check splash blocks or rocks and repair, replace, or replenish as necessary.
- Examine the overflow pipe to make sure that it can safely convey excess flows to a storm drain. Repair or replace any damaged or disconnected piping.
- Check the underdrain piping to make sure it is intact and unobstructed.
- Observe the structure of the box and fix any holes, cracks, rotting, or failure.
- Check that the soil is at the appropriate depth to allow a reservoir above the soil surface and is sufficient to effectively filter stormwater. Remove any accumulations of sediment, litter, and debris. Till or replace soil as necessary. Confirm that soil is not clogging and that the planter will drain within 3-4 hours after a storm event.
- Determine whether the vegetation is dense and healthy. Replace dead plants. Prune or remove any overgrown plants or shrubs that may interface with planter operation. Clean up fallen leaves or debris and replenish mulch. Remove any nuisance or invasive vegetation.

VII. Construction Plan C.3 Checklist

Stormwater Control Plan Reference	BMP Description	Plan Sheet Number
Table 4, Exhibit, and Section II.C	Self-retaining Areas SR-1 thru SR-16 graded to retain first inch of rainfall.	
Table 5 thru Table 9, Exhibit, and Section III.B	Planters PL1, PL-2, PL-3, PL-4 and Bioretention Area BR-1 sized as specified and designed to capture and route drainage from areas delineated on Exhibit.	
Table 2	On-site drain inlets (if any) to be marked with "no dumping" message.	
Table 2	Preserve of any native trees, shrubs, or ground cover.	
Table 2	Plant selection to minimize irrigation, minimize use of fertilizers and pesticides, and for pest assistance.	
Table 2	Any know food service facilities at time of construction required to have suitably sized interior mop sink.	
Table 2, Exhibit	Drain from trash enclosure in building to be connected to sanitary sewer via grease interceptor.	
Table 2	Trash enclosure adjacent to building to be bermed and roofed.	
Table 2	Dumpsters to be marked with "No dumping of hazardous materials or similar	
Table 2	Adequate litter receptacles throughout the commercial area.	
Table 2	Condensate drain lines discharge to landscaped areas or sanitary sewer.	
Table 2	Rooftop mounted equipment to be roofed or covered to prevent pollutants from entering runoff.	
Table 2	Drainage sumps feature sediment sump	
Table 2	Fire sprinkler test valves to be equipped to drain less water to sanitary.	
Table 2	No roofing, gutters, trim made of copper, or unprotected metals that may leach into runoff.	

VIII. Certification

The selection, sizing, and preliminary design of treatment BMPs and other control measures in this plan meet the requirements of Regional Water Quality Control Board Order R2-2003-0022.

APPENDIX

Stormwater Control Plan – Wal-Mart, Antioch
Summary Report

Project Name: Wal-Mart, Antioch
Project Location: 4893 Lone Tree Way, Antioch, CA, 94509
APN or Subdivision Number: 056-011-030-6
Total Project Area (square feet): 273,732
Mean Annual Precipitation at Project Site: 13.3 inches
IMPs designed for: Treatment and flow control

Table 3. Self-treating areas

DMA Name	Area (square feet)
ST-1	943
ST-2	8,757
ST-3	778
Total	10,478

Table 4. Self-retaining areas

DMA Name	Area (square feet)
SR-1	833
SR-2	242
SR-3	60
SR-4	60
SR-5	60
SR-6	60
SR-7	60
SR-8	186
SR-9	250
SR-10	60
SR-11	60
SR-12	60
SR-13	60
SR-14	60
SR-15	366
SR-16	259
SR-17	174
SR-18	173
SR-19	130
SR-20	174
SR-21	174
SR-22	183
SR-23	429
SR-24	174
SR-25	183
SR-26	174
SR-27	199
SR-28	174
SR-29	221
SR-30	502
SR-31	96
SR-32	324
Total	6,220

Stormwater Control Plan – Wal-Mart, Antioch
Summary Report

DMA areas draining to IMPs

Table 5.

DMA Name	*DMA Area (sq. ft.)*	*Post-project surface type*	*Runoff Factor*	*(DMA area) x (runoff factor)*	*Soil Group*	*IMP Name/Type*			
					D	**PL-1/In-Ground Planter**			
PAVE-1	32,956	Concrete/ Asphalt	1.0	32,956	*IMP sizing factor*	*Rainfall adjustment factor*	*Minimum IMP size*	*Proposed IMP size*	*Orifice Diameter*
LAND-1	2,871	Landscape	0.7	2,010					
			Total	34,966	0.05	1.30	2,273 sf	2,816 sf	1.23 in

Table 6.

DMA Name	*DMA Area (sq. ft.)*	*Post-project surface type*	*Runoff Factor*	*(DMA area) x (runoff factor)*	*Soil Group*	*IMP Name/Type*			
					D	**PL-2/In-Ground Planter**			
PAVE-2	37,696	Concrete/ Asphalt	1.0	37,696	*IMP sizing factor*	*Rainfall adjustment factor*	*Minimum IMP size*	*Proposed IMP size*	*Orifice Diameter*
				0					
			Total	37,696	0.05	1.30	2,450 sf	3,095 sf	1.26 in

Table 7.

DMA Name	*DMA Area (sq. ft.)*	*Post-project surface type*	*Runoff Factor*	*(DMA area) x (runoff factor)*	*Soil Group*	*IMP Name/Type*			
					D	**PL-3/In-Ground Planter**			
PAVE-3	27,733	Concrete/ Asphalt	1.0	27,733	*IMP sizing factor*	*Rainfall adjustment factor*	*Minimum IMP size*	*Proposed IMP size*	*Orifice Diameter*
				0					
			Total	27,733	0.05	1.30	1,803 sf	2,782 sf	1.08 in

Table 8.

DMA Name	*DMA Area (sq. ft.)*	*Post-project surface type*	*Runoff Factor*	*(DMA area) x (runoff factor)*	*Soil Group*	*IMP Name/Type*			
					D	**PL-4/In-Ground Planter**			
PAVE-5	2,680	Concrete/ Asphalt	1.0	2,680	*IMP sizing factor*	*Rainfall adjustment factor*	*Minimum IMP size*	*Proposed IMP size*	*Orifice Diameter*
ROOF-2	3,761	Roof	1.0	3,761					
ROOF-3	2,060	Roof	1.0	2,060					
				0					
			Total	8,501	0.05	1.30	553 sf	999 sf	0.60 in

Stormwater Control Plan – Wal-Mart, Antioch
Summary Report

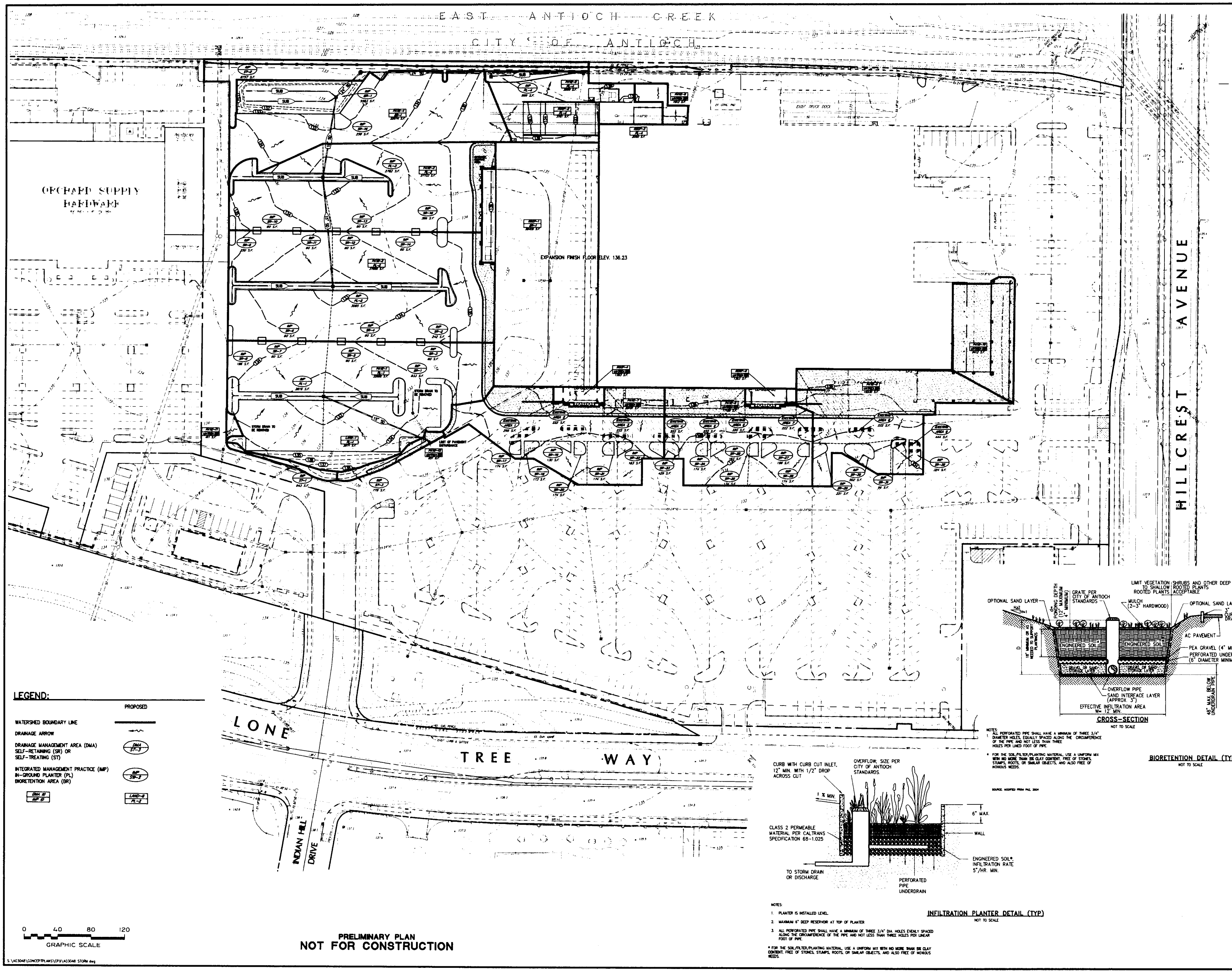
Table 9.

DMA Name	*DMA Area (sq. ft.)*	*Post-project surface type*	*Runoff Factor*	*(DMA area) x (runoff factor)*	*Soil Group*	*IMP Name/Type*			
					D	**BR-1/Bioretention Area**			
PAVE-4	22,074	Concrete/ Asphalt	1.0	22,074	*IMP sizing factor*	*Rainfall adjustment factor*	*Minimum IMP size*	*Proposed IMP size*	*Orifice Diameter*
ROOF-1	38,406	Roof	1.0	38,406					
			Total	60,480	0.06	1.30	4,717 sf	5,583 sf	2.53 in

Table 10. Tabulation of Site Areas (sq. ft.)

Total Area of Self-Treating Areas	10,478
Total Area of Self Retaining Areas	6,220
Total Area of DMA draining to Self-Retaining Areas	0
Total Area of IMPs	15,275
Total Area of DMA draining to IMPs	170,237
Total Area of untreated stormwater[(1)]	71,522
Total Area of Site	273,732

[(1)] It is impracticable to treat 68,648 square feet of the untreated stormwater. Refer to Section I.C. – Opportunities and Constraints for Stormwater Control for further explanation. The remaining 2,874 square feet of untreated impervious area comprises 1% of the total area of the site.


EAST ANTIOCH CREEK
CITY OF ANTIOCH
HILLCREST AVENUE
LONE TREE WAY
INDIAN HILL DRIVE
ORCHARD SUPPLY HARDWARE
EXPANSION FINISH FLOOR ELEV. 136.23
N
LEGEND:
PROPOSED
WATERSHED BOUNDARY LINE
DRAINAGE ARROW
DRAINAGE MANAGEMENT AREA (DMA) SELF-RETAINING (SR) OR SELF-TREATING (ST)
INTEGRATED MANAGEMENT PRACTICE (IMP) IN-GROUND PLANTER (PL) BIORETENTION AREA (BR)
0 40 80 120
GRAPHIC SCALE
PRELIMINARY PLAN
NOT FOR CONSTRUCTION
LIMIT VEGETATION TO SHALLOW ROOTED PLANTS
SHRUBS AND OTHER DEEP ROOTED PLANTS ACCEPTABLE
OPTIONAL SAND LAYER
GRATE PER CITY OF ANTIOCH STANDARDS
MULCH (2-3" HARDWOOD)
OPTIONAL SAND LAYER
3" THRU CURB DRAIN
AC PAVEMENT
ENGINEERED SOIL
GRAVEL OR SAND STORAGE LAYER
PEA GRAVEL (4" MINIMUM)
PERFORATED UNDERDRAIN PIPE (6" DIAMETER MINIMUM)
OVERFLOW PIPE
SAND INTERFACE LAYER (APPROX. 3")
EFFECTIVE INFILTRATION AREA W= 12' MIN.
48" MAX. BELOW UNDERDRAIN PIPE
CROSS-SECTION
NOT TO SCALE
NOTES:
1. ALL PERFORATED PIPE SHALL HAVE A MINIMUM OF THREE 3/4" DIAMETER HOLES, EQUALLY SPACED ALONG THE CIRCUMFERENCE OF THE PIPE AND NOT LESS THAN THREE HOLES PER LINED FOOT OF PIPE.
* FOR THE SOIL/FILTER/PLANTING MATERIAL, USE A UNIFORM MIX WITH NO MORE THAN 5% CLAY CONTENT, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.
SOURCE: MODIFIED FROM PAZ, 2004
BIORETENTION DETAIL (TYP)
NOT TO SCALE
CURB WITH CURB CUT INLET, 12" MIN. WITH 1/2" DROP ACROSS CUT
OVERFLOW, SIZE PER CITY OF ANTIOCH STANDARDS.
1 % MIN.
6" MAX.
WALL
CLASS 2 PERMEABLE MATERIAL PER CALTRANS SPECIFICATION 68-1.025
TO STORM DRAIN OR DISCHARGE
PERFORATED PIPE UNDERDRAIN
ENGINEERED SOIL*, INFILTRATION RATE 5"/HR. MIN.
NOTES:
1. PLANTER IS INSTALLED LEVEL.
2. MAXIMUM 6" DEEP RESERVOIR AT TOP OF PLANTER.
3. ALL PERFORATED PIPE SHALL HAVE A MINIMUM OF THREE 3/4" DIA. HOLES EVENLY SPACED ALONG THE CIRCUMFERENCE OF THE PIPE AND NOT LESS THAN THREE HOLES PER LINEAR FOOT OF PIPE.
* FOR THE SOIL/FILTER/PLANTING MATERIAL, USE A UNIFORM MIX WITH NO MORE THAN 5% CLAY CONTENT, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.
INFILTRATION PLANTER DETAIL (TYP)
NOT TO SCALE

PRELIMINARY STORM WATER CONTROL PLAN EXHIBIT

WAL-MART STORE 2697 EXPANSION

CITY OF ANTIOCH, CALIFORNIA

FOR: WAL-MART STORES INC.

SCALE	1"=40'
DATE	10/02/2008
DRAWN	C.L.A.
CHECKED	T.A.A.
PROJ. MGR.	T.A.A.

SHEET REVISIONS: DATE | MK | BY | CK

SHEET NO. SW-1 OF 1 SHEETS

JOB NO. A03048

RAK CIVIL ENGINEERS
ROBERT A. KARN & ASSOCIATES, INC.
707 BECK AVENUE
FAIRFIELD, CALIFORNIA 94533
Phone: (707) 435-9999 Fax: (707) 435-9988
e-mail: rakwakengineers.com

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