Appendix E Standard Urban Storm Water Mitigation Plan

Appendix

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Standard Urban Storm Water Mitigation Plan (SUSMP)
for

CORNERSTONE BIBLE CHURCH
400 Glendora Avenue
Glendora, CA 91741

Prepared by:

STRUCTURAL ENGINEERING • CIVIL ENGINEERING • SURVEYING • LAND PLANNING
9449 Balboa Avenue, Suite 270
San Diego, CA 92123
BWE Job #: 12605us.2

October, 2020

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Project Owner's Certification

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner's Name:	Cornerstone Bible Church		
Owner's Title:			
Company:			
Address:	400 Glendora Avenue, Glendora, CA 91741		
Email:			
Telephone No:			
Signature:		Date:	

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Preparer (Engineer) Certification

Engineer's Name:	Michael Slawson, P.E., PLS, Q.S.D		
Engineer's Title:	Principal		
Company:	BWE Inc.,		
Address:	9449 Balboa Avenue, Suite 270 San Diego, CA 92123		
Email:	mslawson@bwesd.com		
Telephone No:	619.299.5550		
I hereby certify that this Low Impact Development Plan is in compliance with, and meets the requirements set forth in, Order No. R4-2012-0175, of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	
Place Stamp Here			

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Table of Contents

Attachments

1. PROJECT DESCRIPTION

1.1. PROJECT CATEGORY

Check which box best represents the proposed project category. Only check "Yes" for one box.

Category	YES	NO
1. Development [a] of a new project equal to 1 acre or greater of disturbed area and adding more than 10,000 square feet of impervious area [b]	☐	☒
2. Development [a] of a new industrial park with 10,000 square feet or more of surface area [c]	☐	☒
3. Development [a] of a new commercial mall with 10,000 square feet or more surface area [c]	☐	☒
4. Development [a] of a new retail gasoline outlet with 5,000 square feet or more of surface area [c]	☐	☒
5. Development [a] of a new restaurant (SIC 5812) with 5,000 square feet or more of surface area [c]	☐	☒
6. Development [a] of a new parking lot with either 5,000 ft^2 or more of impervious area [b] or with 25 or more parking spaces	☐	☐
7. Development [a] of a new automotive service facility (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) with 5,000 square feet or more of surface area [c]	☒	☒
8. Projects located in or directly adjacent to, or discharging directly to a Significant Ecological Area (SEA),[d] where the development will: a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and b. Create 2,500 square feet or more of impervious area [b]	☐	☒
9. Redevelopment [e] of 5,000 square feet or more in one of the categories listed above **If yes, list redevelopment category here:** 1, 6	☒	☐
10. Redevelopment [e] of 10,000 square feet or more to a Single Family Home, without a change in land use.	☐	☒

a Development includes any construction or demolition activity, clearing, grading, grubbing, or excavation or any other activity that results in land disturbance.

b Surfaces that do not allow stormwater runoff to percolate into the ground. Typical impervious surfaces include: concrete, asphalt, roofing materials, etc.

c The surface area is the total footprint of an area. Not to include the cumulative area above or below the ground surface.

d An area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and would be disturbed or degraded by human activities and developments. Also, an area designated by the City as approved by the Regional Water Quality Control Board.

e Land-disturbing activities that result in the creation, addition, or replacement of a certain amount of impervious surface area on an already developed site. If the activity results in an alteration to more than 50% of the impervious surface area on the already developed site and the existing site was not subject to post-construction storm water quality control requirements, then the entire site must be mitigated.

1.2. PROJECT DESCRIPTION

Total Project Area (ft^2): 55,756.8
Total Project Area (Ac): 1.28

EXISTING CONDITIONS

Condition	Area (ft^2)	Percentage (%)
Pervious Area:	22,303	40
Impervious Area:	33,454	60

PROPOSED CONDITIONS

Condition	Area (ft^2)	Percentage (%)
Pervious Area:	14,810	26.6
Impervious Area:	40,946	73.4

SITE CHARACTERISTICS

DRAINAGE PATTERNS/CONNECTIONS *[Include a detailed description of existing and proposed drainage patterns. Describe the areas and sub-areas (to include square footage), treatment locations, direction of flow through each area, discharge point(s), ultimate termination point, etc.]*	**Existing:** The project site was previously developed and comprised of a double story Church building, paved parking, a modular structure, concrete walkways, and children's play area. The topography of the majority site area is relatively flat (1-2%) and generally slopes from north to south and east to west directions. Runoff from the easterly portion of the site flows south to Whitcomb Avenue. Similarly, the runoff from the westerly portion of the site surface flows to Whitcomb Avenue as well as Glendora Avenue. The runoff from the site ultimately discharges to County's storm drain system through existing curb inlets and storm drain pipes situated within Whitcomb and Glendora Avenues. This storm drain system originates from offsite drainage area and discharges to Dalton Wash situated southerly side of the site. Dalton Wash ultimately discharges into the San Gabriel River via Walnut Creek.
	Proposed: The majority parking lot runoff surface flows northwest via proposed gutters to catch basins prior to discharging offsite. A new storm drain system is also proposed for the collection and conveyance of the site runoff to proposed BMPs and offsite. The runoff from majority site area drains to the existing catch basin situated at the Whitcomb Avenue. Two retention/detention basins are also proposed to mitigate the drainage impacts (quality & quantity) due to the redevelopment.
NARRATIVE PROJECT DESCRIPTION: *[Include a detailed description of project areas, type of facilities, activities conducted onsite, materials and products received and stored on site, SIC Code (if applicable), land uses, land cover, design elements, drainage management areas (DMAs), etc.]*	The existing church building will be preserved. The proposed development will consist of a large single story building and two smaller structures, new parking lot with ADA parking stalls, walkways, new play area, and landscaping. Parking lots are situated at the easterly side of the site which replaces the existing residential buildings. The parcel is approximately 1.28 acres in total, of which more than 50% area will be redeveloped.

	The site design also includes construction of storm drain conveyance system, retention/detention basin, planters, and landscape areas. The project will also include associated improvements such as curbs, walkways, and utilities. The Low Impact Development (LID) strategies are also designed to mimic the existing drainage pattern.

OFFSITE RUNON *[Describe any offsite runon anticipated and how the runon will be either accounted for in LID BMP sizing or directed around the site.]*	Runon is not anticipated from the offsite areas.
UTILITY AND INFRASTRUCTURE INFORMATION *[Include a description of the existing and proposed onsite utility and infrastructure. Evaluate the potential impacts of stormwater infiltration on subsurface utilities, establish necessary setbacks, and if the utilities need to be relocated. Retention-based stormwater quality control measures should not be located near utility lines where an increased volume of water could damage utilities.]*	Proposed site utilities include but are not limited to the sewer, water, irrigation, gas, and electric.
SIGNIFICANT ECOLOGICAL AREAS (SEAS) *[Identify any known Significant Ecological Area (SEA) which the project is located in or directly adjacent to, or discharging directly to.]*	There are no Significant Ecological Areas present onsite.

1.3. HYDROMODIFICATION ANALYSIS

DOES THE PROPOSED PROJECT FALL INTO ONE OF THE FOLLOWING CATEGORIES? CHECK YES/NO.	YES	NO
1. *Project is a redevelopment that decreases the effective impervious area compared to the pre-project conditions.*	☐	☒
Describe: Impervious are will increase due to the redevelopment.		
2. *Project is a redevelopment that increases the infiltration capacity of pervious areas compared to the pre-project conditions.*	☐	☒
Describe: Pervious areas will be planted/landscaped with soil with better infiltration characteristics than in the existing condition. Since the impervious area is increased from the existing this credit cannot be used.		
3. *Project discharges directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q_{100}) of 25,000 cfs or more.*	☐	☒
Describe: Project discharges into a waterway that has a 100-year peak flow rate of less than 25,000 cfs.		
4. *Project discharges directly or via a storm drain into concrete or otherwise engineered (not natural) channels (e.g., channelized or armored with rip rap, shotcrete, etc.), which, in turn, discharge into receiving water that is not susceptible to hydromodification impacts.*	☐	☒
Describe: Project discharges via storm drain into San Gabriel River which is susceptible to hydromodification impacts.		

[Check "Yes" or "No," as applicable.

If one or more of the above criteria are checked "Yes," the project is exempt from Hydromodification Control Measures.

*If none of the above criteria are checked "Yes," **the project will require Hydromodification control measures**. Include detailed description of control measures to be implemented and a reference to calculations following the criteria outlined in MS4 Permit (Order R4-2012-0175) §VI.D.7.c.iv]*

1.4. PROPERTY OWNERSHIP/MANAGEMENT

[Describe ownership of all portions of project and site. Include information on if any infrastructure transfer to public agencies (City, County, Caltrans, etc.). Describe any property management company/association that will be formed. Include leasee information, as applicable.]	Property is owned and managed by Cornerstone Bible Church.

2. BEST MANAGEMENT PRACTICES (BMPS)

2.1. SITE DESIGN

85TH PERCENTILE, 24-HOUR STORM DEPTH *[Determined from the Los Angeles County 85th percentile precipitation isohyetal map. If less than 0.75 inch, state as such and use 0.75 inch throughout.]*	1.0 inch
Site Design *[Describe site design and drainage plan including; site design practices utilized and how BMPs are incorporated using the appropriate hierarchy.]*	The following site design BMPs are considered/implemented in the site design where feasible; • *Minimize Directly Connected Impervious Areas* o Landscaped areas are implemented in the site design to minimize directly connected impervious area (roofs and walkways). The location of the landscape areas are shown on the SUSMP Exhibit in Attachment A. • *Create Reduced or "Zero Discharge" Areas* o Onsite irrigation drainage and any sub-drain systems will not discharge in an uncontrolled manner; o Drain rooftops into adjacent landscaping area prior to discharging to the storm drain; o Landscape plans will utilize native, drought-tolerant landscape materials where feasible; and • *Minimize Impervious Area, Maximize Permeability* o Sidewalk and parking lot aisles are designed to the minimum widths necessary while maintaining a walkable environment. o Permeable pavement is utilized for parking stalls where underground retention vault is proposed

BMP LIST

[Fill out the table below with information on the BMPs incorporated in each Drainage Management Area (DMA)]

WETLANDMOD BMP Summary Table

85th Percentile, 24-hour storm = 1.0 in/hr
Soil Type = 6
SWQDv = Stormwater Quality Design Volume (calcualted using HydroCalc)

BMP #	Basin/DMA #	Area (ac)	%Impervious	85th Percentile Storm Volume (cf)		BMP Sizing (5"/hr & 72 hr Drawdown)	
				SWQDv	1.5xSWQDv	Prop. BMP Model	Max. WQ Volume (cf)
1	A-1	0.67	72.0%	1,630.00	**2,445**		
2	A-2	0.61	75.0%	1,537.00	**2,306**		

2.2. BMP SELECTION

2.2.1. INFILTRATION BMPS

NAME	INCLUDED *[Check all that apply.]*
Bioretention without underdrains	☐
Infiltration Trench	☐
Infiltration Basin	☐
Drywell	☐
Proprietary Subsurface Infiltration Gallery	☐
Permeable Pavement (concrete, asphalt, pavers)	☒
Other:	☐
Other:	☐

DESCRIPTION *[Describe Infiltration BMPs. Include descriptions on selection, sizing, and feasibility, as applicable. If infiltration is infeasible, provide brief explanation, including reference to the geotechnical report.]*	Infiltration based BMPs will be implemented to retain the SWQDv onsite only if site support native infiltration rate of 0.3 in/hr or more. Actual infiltration rate for the site is unknown at this time. Therefore, it is determined to be technically infeasible to reliably retain 100 percent of the SWQDv on-site. An alternative compliance measure is implemented to comply with the retention requirement per Section 7.4 of the LA County LID Manual as stated below. ***On-site biofiltration of 1.5 times the volume of the SWQDv that is not reliably retained on-site.***
CALCULATIONS *[Show calculations to demonstrate that the Storm Water Quality Design volume can be met with Infiltration BMPs.]*	Not Applicable.

2.2.2. RAINWATER HARVEST AND USE BMPS

NAME	INCLUDED *[Check all that apply.]*
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

DESCRIPTION *[Describe Rainwater Harvest and Use BMPs. Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.]*	Rainwater Harvest and Use BMPs are not implemented because of the infrequent nature of the rainfall in the region. These BMPs cannot be used as a standalone source of water supply for irrigation and/or any other onsite use.
CALCULATIONS *[Show calculations to demonstrate if the Storm Water Quality Design volume can be met with Rainwater Harvest and Use BMPs. If not, document how much can be met with Rainwater Harvest and Use and why it is not feasible to meet the full volume with Rainwater Harvest and Use BMPs.]*	Not Applicable.

2.2.3. ALTERNATIVE COMPLIANCE BMPS

BIOFILTRATION BMPS

(If Infiltration BMPs and Rainwater Harvest and Use BMPs are Infeasible)

NAME	INCLUDED *[Check all that apply.]*
Bioretention with underdrains (i.e. planter box, rain garden, etc.)	☐
Constructed Wetland	☐
Vegetated Swale	☐
Vegetated Filter Strip	☐
Tree-Well Filter	☐
Other: Proprietary Biofiltration BMP (WetlandMod)	☒
Other:	☐

DESCRIPTION *[If the full Design Storm Capture Volume cannot be met with Infiltration BMPs, and/or Rainwater Harvest and Use BMPs, describe Biofiltration BMPs. Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.]*	Feasibility study of all retention based BMPs (harvest and use, full and/or partial infiltration) is performed prior to selecting the biofiltration BMP to comply with the LID requirements. It is determined that the harvest and use of precipitation is infeasible because the site has very low water demand for irrigation and toilets flushing. Similarly, infiltration based BMPs are not feasible because the site is assumed to have low infiltration rate (less than 0.3 in/hr – Geotech to confirm). Therefore, proprietary biofiltration BMPs are designed to capture, and treat the runoff originating from the site. Proprietary Biofiltration BMP (WetlandMod): Proprietary biotreatment devices are proposed for the runoff treatment and as an alternative to retention of SWQDv onsite. These devices have smaller footprints than the conventional biofiltration system. Two WetlandMod units are implemented for this site.
CALCULATIONS *[Show calculations to demonstrate how 1.5 times the Storm Water Quality Design volume and/or flowrate can be met with Biotreatment BMPs.]*	Refer to Section 2.1 for results. The BMPs are designed by considering the design volume equal to 1.5 times the SWQDv to account for onsite retention of SWQDv.

OFFSITE BMPS

(If Infiltration BMPs, Rainwater Harvest and Use BMPs, and Biofiltration BMPs are Infeasible)

NAME	INCLUDED *[Check all that apply.]*
Offsite Infiltration	☐
Ground Water Replenishment Projects	☐
Offsite Project - Retrofit Existing Development	☐
Regional Storm Water Mitigation Program	☐
Other:	☐
Other:	☐

DESCRIPTION *[If the full Design Storm Capture Volume cannot be met with Infiltration BMPs, Rainwater Harvest and Use BMPs, or Biofiltration BMPs, describe proposed Alternative Compliance BMPs. Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.]*	Not Applicable.
CALCULATIONS *[Show calculations to demonstrate how the conditions required by the MS4 Permit will be met with Alternative Compliance BMPs.]*	Not Applicable.

2.2.4. TREATMENT CONTROL BMPS

Treatment control BMPs can only be used as pre-treatment to LID BMPs.

NAME	INCLUDED *[Check all that apply.]*
Media Filter	☐
Filter Insert	☐
CDS Unit	☐
Other:	☐
Other:	☐

DESCRIPTION *[Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.]*	These BMPs are not utilized onsite. Not Applicable.

2.2.5. HYDROMODIFICATION CONTROL BMPS

NAME	INCLUDED *[Check all that apply.]*
Infiltration System	☐
Above-ground Cistern	☐
Above-ground Basin	☐
Underground Detention	☒
Other:	☐
Other:	☐

DESCRIPTION *[If the site is susceptible to hydromodification, include descriptions on selection and sizing of Hydromodification Control Measures.]*	The storm runoff from the site discharges to the natural river/waterway via storm drain conduit prior to discharging into the exempt water body (Ocean). The natural river is susceptible to hydromodification due to the increased flow rates and durations. Therefore, project is required to implement the hydromodification control measures per Section 8 of the County of Los Angeles LID Manual. All Designated & Non-Designated projects which are required to analyze for hydromodification impacts must conduct hydrology and hydraulic frequency analyses for LID, 2-, 5-, 10-, 25-, and 50-year storm events per the LACDPW Hydraulic and Hydrology manuals. The frequency analyses, require to analyze changes in flow velocity, volume, and depth/width of flow for all natural receiving system using HEC-RAS, to demonstrate compliance with hydromodification requirements and identify drainage impacts on off-site property. This type of analysis will require an intensive studies (hydrology and hydraulic) of an offsite receiving system which is determined to be infeasible for a small redevelopment projects like this. Therefore, this project is seeking for infeasibility of hydromodification implementation as below; • The stormwater runoff flow rate, volume, velocity, and duration for the post-development condition does not exceed the pre-development condition for the 2-year, 24-hour rainfall event, Note: Volume mitigation cannot be verified because actual native infiltration rate is unknown at this time. Therefore, only peak flow rate for 2-year, 24-hour event is mitigated in the proposed condition. And, • Obtain Drainage Acceptance Letters from the owner of every impacted downstream property. Note: Peak flow rate in the proposed condition is maintained to existing condition level. Therefore, there is no net peak flow rate increase which adversely impacts the downstream property owners. Also, site is an urban infill project which discharges directly to an existing underground storm drain system. Since the runoff is contained within a closed conduit the adverse impact to the downstream properties is not anticipated. Therefore, it is determined that obtaining drainage acceptance letter

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from the downstream property owners is not necessary.

The peak flow rate due to 2-year, 24-hour rainfall frequency is mitigated by routing the flow through an underground retention/detention basin. The results are summarized below (see attachment A for calculations). Two new detention basins with storage volumes equal to 1,650 and 1,550 cfs are proposed for this purpose. Since the actual infiltration rate for the site is not available the volume reduction for 2-year, 24-hour rainfall frequency cannot be analyzed at this stage.
<table>
<tr><th colspan="3">2 yr, 24-hr Flow (cfs)</th><th rowspan="2">% Change from Existing Condition</th></tr>
<tr><th>Existing Condition</th><th>Proposed Condition</th><th>Proposed Condition (Mitigated)</th></tr>
<tr><td>0.30</td><td>0.37</td><td>0.37</td><td>0</td></tr>
</table>

The peak flow rate is maintained in the proposed condition. Therefore, downstream impact is not anticipated
</td>
</tr>
<tr>
<td>CALCULATIONS
[If the site is susceptible to hydromodification, show calculations to demonstrate how the volume, flowrate, and duration conditions can be met with Hydromodification Control Measures BMPs.]</td>
<td>Not Applicable. Project is seeking for infeasibility of Hydromodification Implementation.</td>
</tr>
</table>

2.2.6. NON-STRUCTURAL SOURCE CONTROL BMPS

NAME	CHECK ONE	
	Included	**Not Applicable**
Education for Property Owners, Tenants and Occupants	☒	☐
Activity Restrictions	☒	☐
Common Area Landscape Management	☒	☐
Common Area Litter Control	☒	☐
Housekeeping of Loading Docks	☐	☒

Common Area Catch Basin Inspection	☒	☐
Street Sweeping Private Streets and Parking Lots	☒	☐

2.2.7. STRUCTURAL SOURCE CONTROL BMPS

NAME	CHECK ONE	
	Included	**Not Applicable**
Provide storm drain system stenciling and signage	☒	☐
Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒
Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐
Protect slopes and channels and provide energy dissipation	☒	☐
Loading docks	☐	☒
Maintenance bays	☐	☒
Vehicle wash areas	☐	☒
Outdoor processing areas	☐	☒
Equipment wash areas/racks	☐	☒
Fueling areas	☐	☒
Hillside landscaping	☐	☒

Attachment A

Calculations/DMA Map

[Include Drainage Area Map and calculations for each BMP following an approved published design standard (i.e. City Manuals, County Manuals, Caltrans, CASQA, etc.). Calculations must be followed step-by-step with no alterations. Also, include an excerpt from the design standard used.]

Peak Flow Hydrologic Analysis

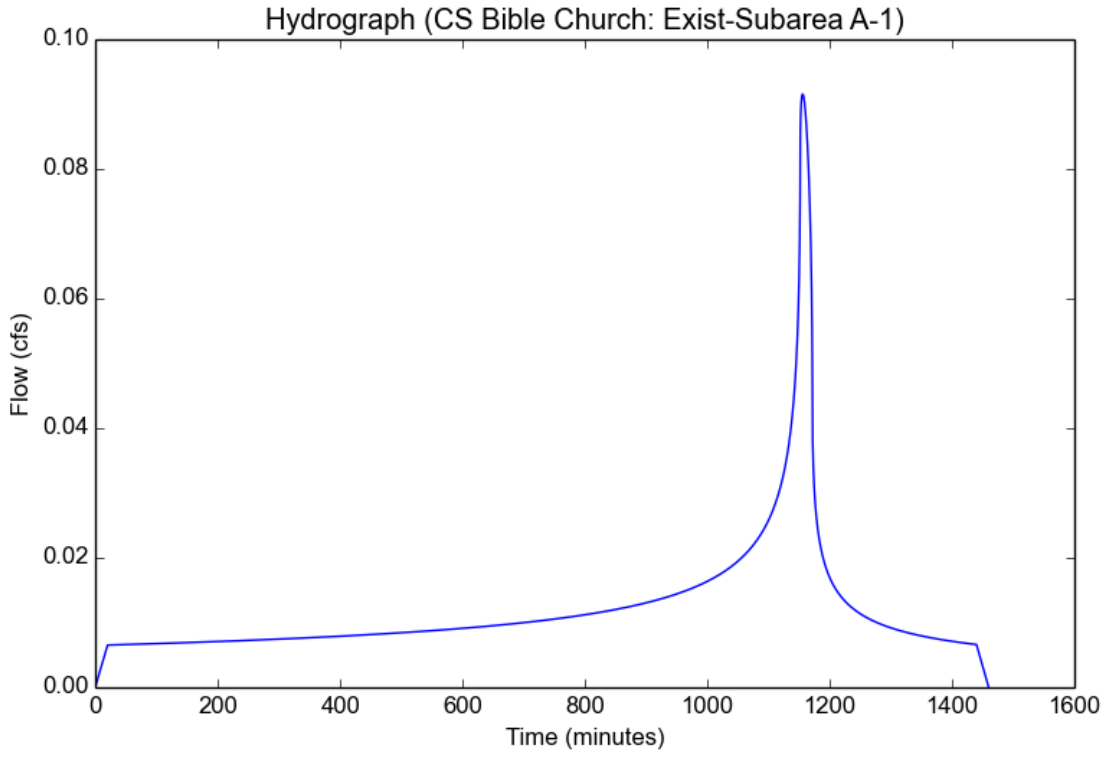
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/SWQMP/2020-08 Report/85th percentile/CS Church_exist
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CS Bible Church
Subarea ID	Exist-Subarea A-1
Area (ac)	0.64
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.45
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.311
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.46
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.0916
Burned Peak Flow Rate (cfs)	0.0916
24-Hr Clear Runoff Volume (ac-ft)	0.0243
24-Hr Clear Runoff Volume (cu-ft)	1059.8454



Peak Flow Hydrologic Analysis

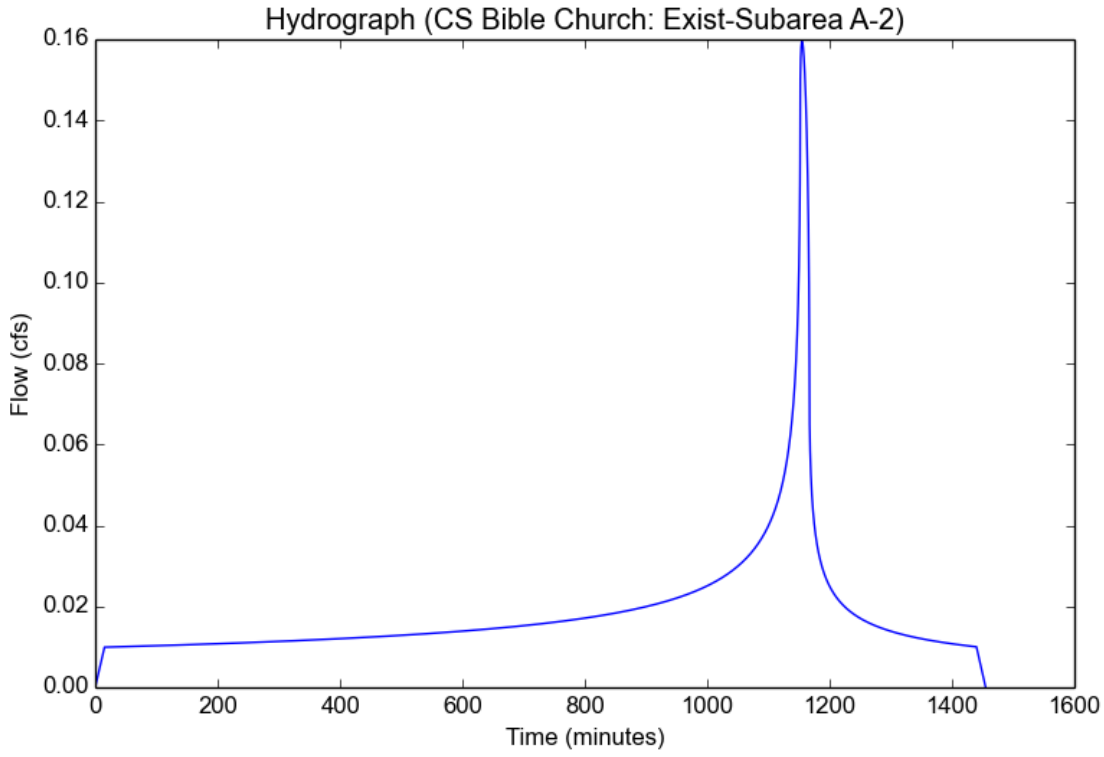
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/SWQMP/2020-08 Report/85th percentile/CS Church_exist
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CS Bible Church
Subarea ID	Exist-Subarea A-2
Area (ac)	0.64
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.356
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.1595
Burned Peak Flow Rate (cfs)	0.1595
24-Hr Clear Runoff Volume (ac-ft)	0.037
24-Hr Clear Runoff Volume (cu-ft)	1612.8046



Peak Flow Hydrologic Analysis

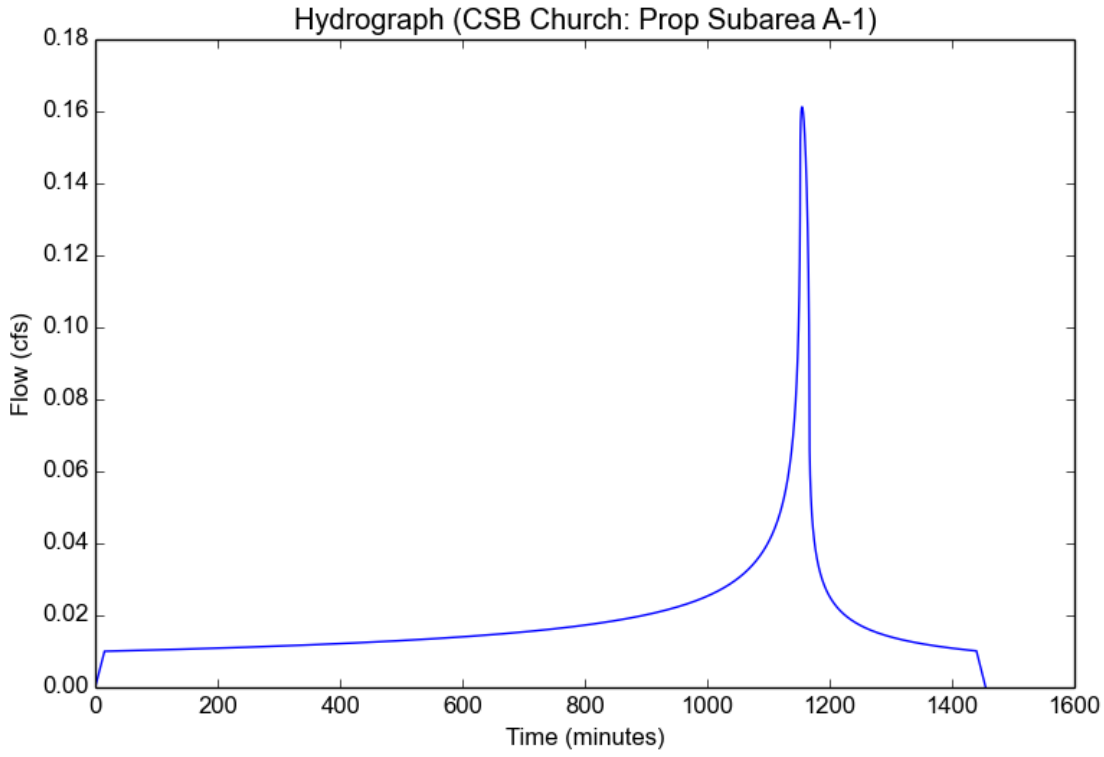
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/SWQMP/2020-08 Report/85th percentile/CS Church_Prop
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CSB Church
Subarea ID	Prop Subarea A-1
Area (ac)	0.67
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.72
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.356
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.676
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.1612
Burned Peak Flow Rate (cfs)	0.1612
24-Hr Clear Runoff Volume (ac-ft)	0.0374
24-Hr Clear Runoff Volume (cu-ft)	1630.5166



Peak Flow Hydrologic Analysis

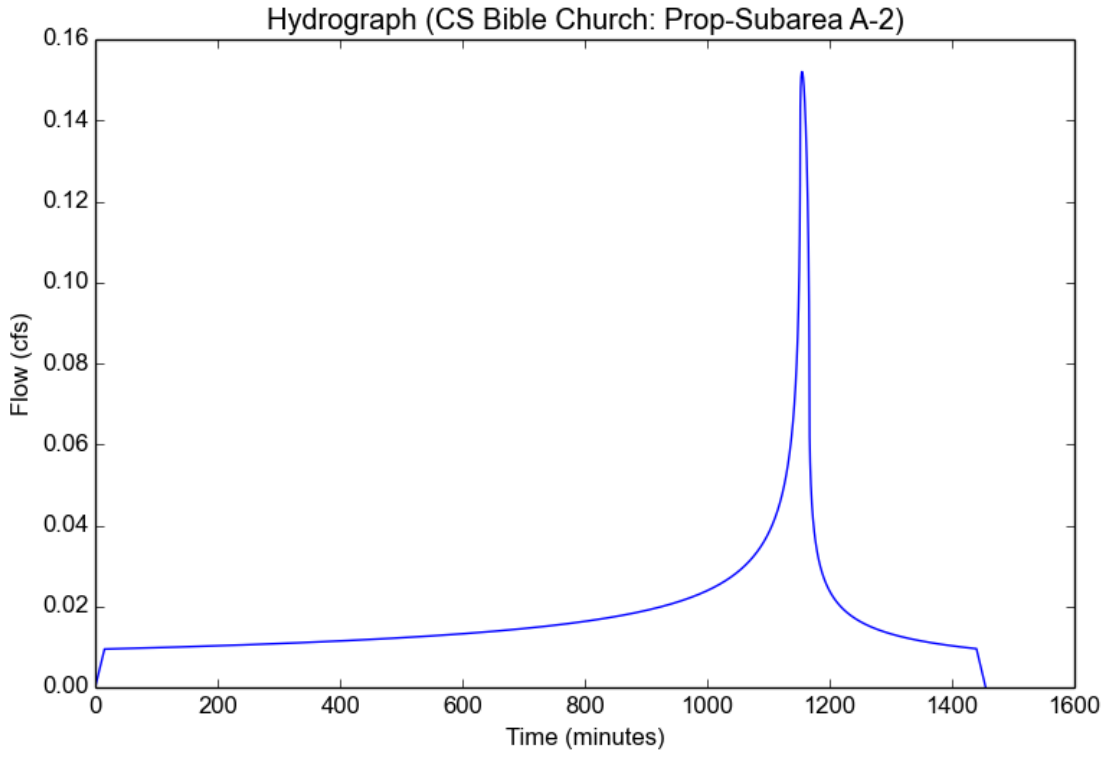
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/SWQMP/2020-08 Report/85th percentile/CS Church_Prop
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CS Bible Church
Subarea ID	Prop-Subarea A-2
Area (ac)	0.61
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.356
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.152
Burned Peak Flow Rate (cfs)	0.152
24-Hr Clear Runoff Volume (ac-ft)	0.0353
24-Hr Clear Runoff Volume (cu-ft)	1537.2044



Peak Flow Hydrologic Analysis

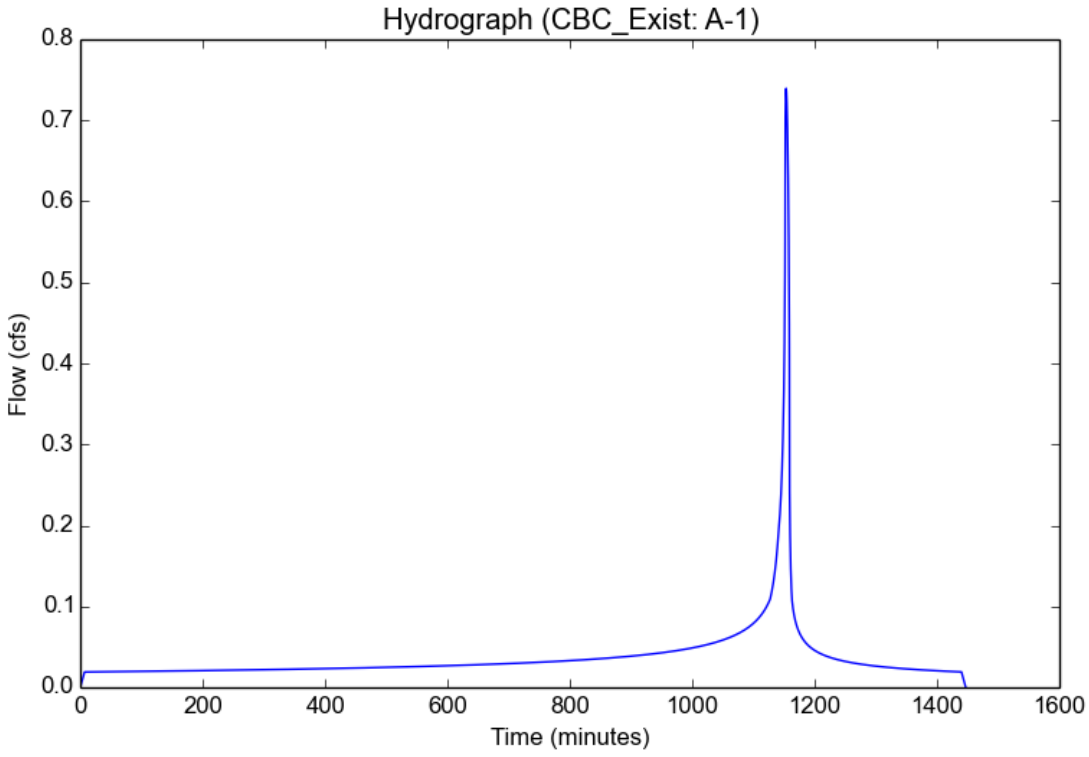
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/CBC_Exist F
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-1
Area (ac)	0.64
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.45
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.4883
Undeveloped Runoff Coefficient (Cu)	0.6752
Developed Runoff Coefficient (Cd)	0.7764
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.7395
Burned Peak Flow Rate (cfs)	0.7395
24-Hr Clear Runoff Volume (ac-ft)	0.0753
24-Hr Clear Runoff Volume (cu-ft)	3281.9673



Peak Flow Hydrologic Analysis

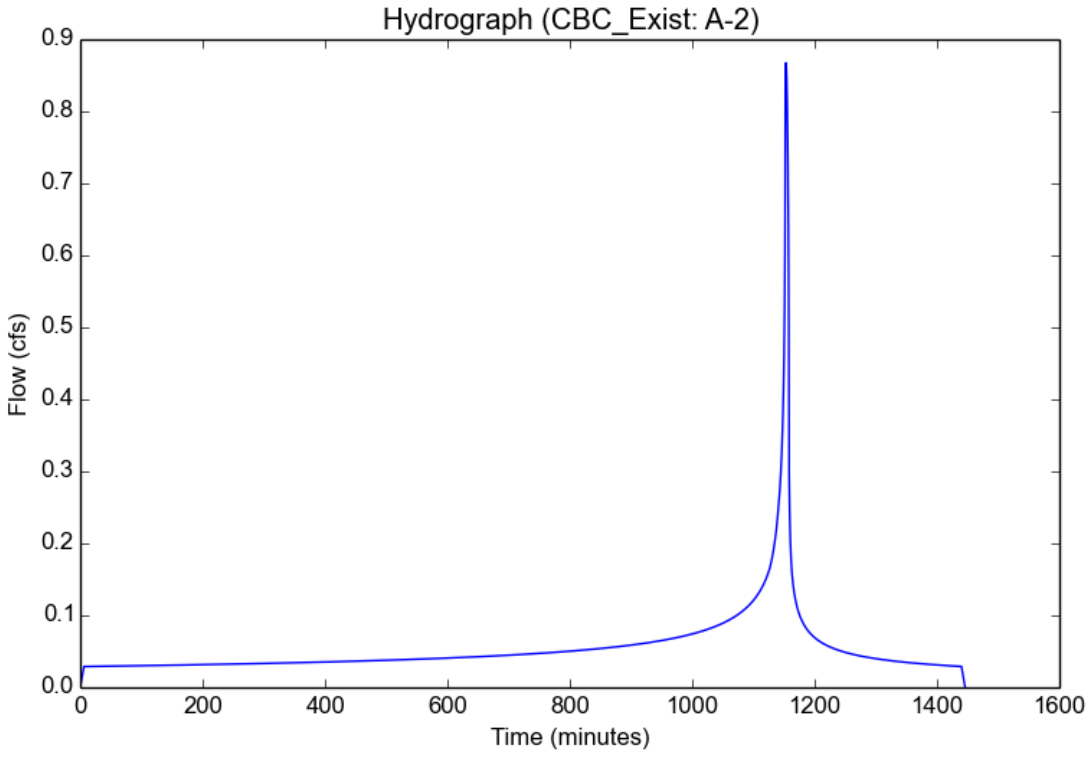
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/CBC_Exist F
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-2
Area (ac)	0.64
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8471
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.8675
Burned Peak Flow Rate (cfs)	0.8675
24-Hr Clear Runoff Volume (ac-ft)	0.1101
24-Hr Clear Runoff Volume (cu-ft)	4796.8406



Peak Flow Hydrologic Analysis

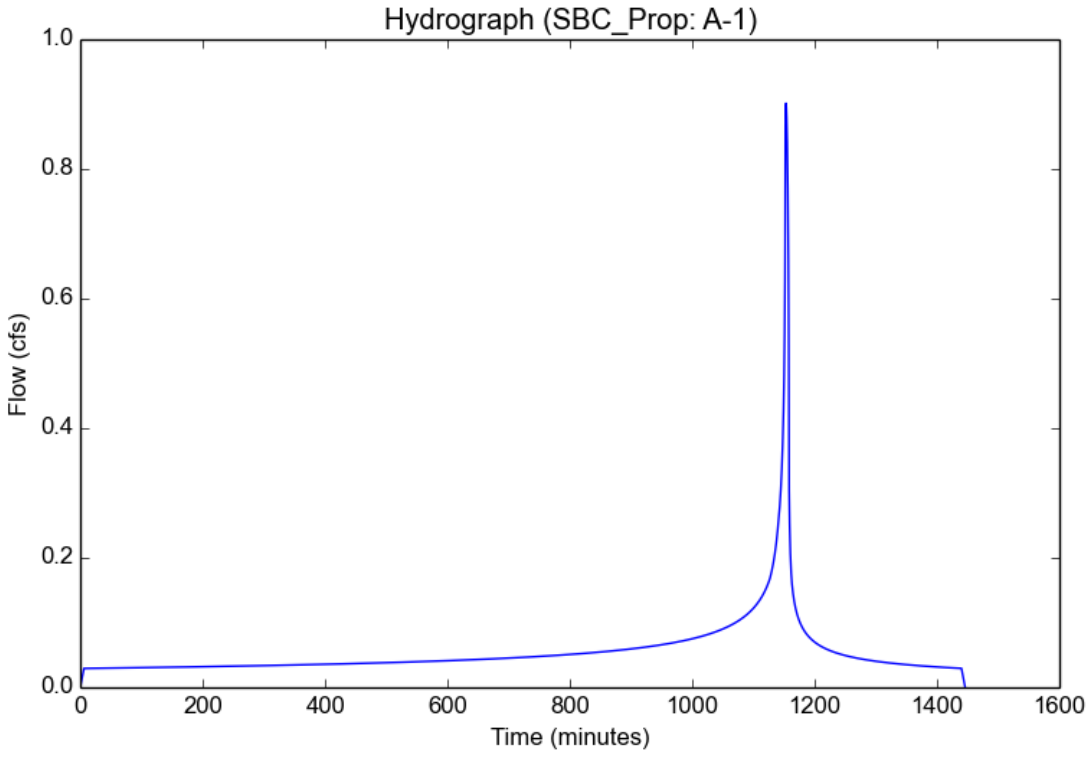
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/SBC_Prop R
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-1
Area (ac)	0.67
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.72
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8408
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.9013
Burned Peak Flow Rate (cfs)	0.9013
24-Hr Clear Runoff Volume (ac-ft)	0.1116
24-Hr Clear Runoff Volume (cu-ft)	4863.165



Peak Flow Hydrologic Analysis

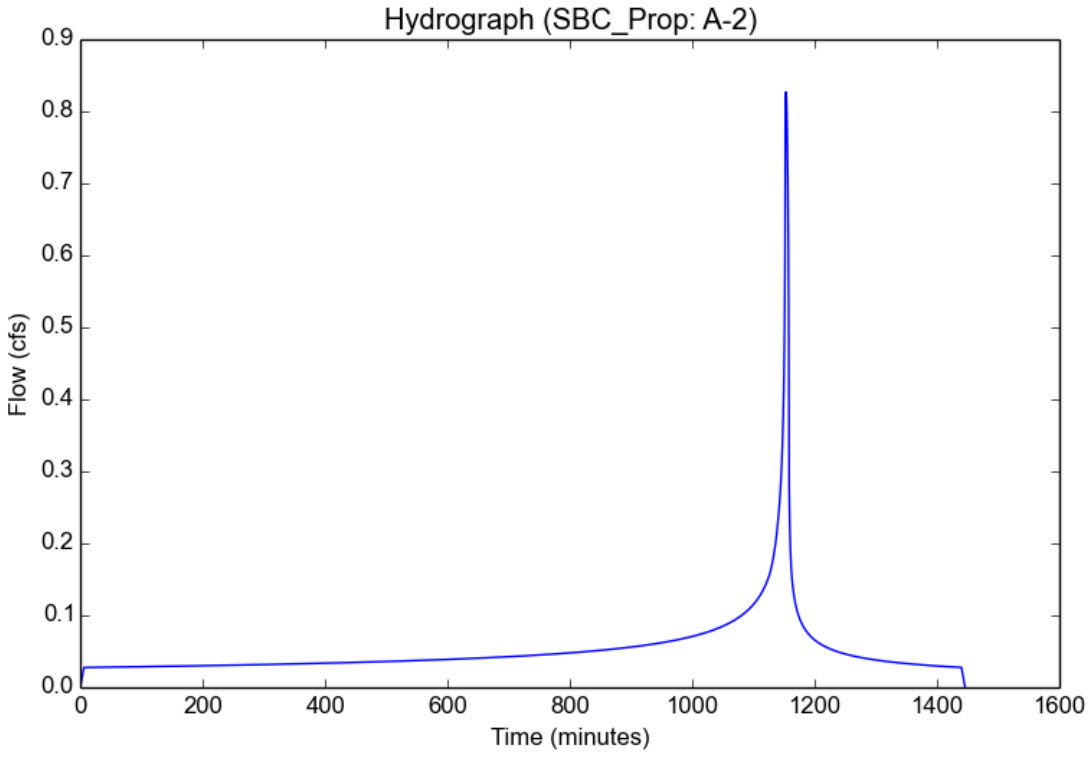
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/SBC_Prop R
Version: HydroCalc 1.0.3

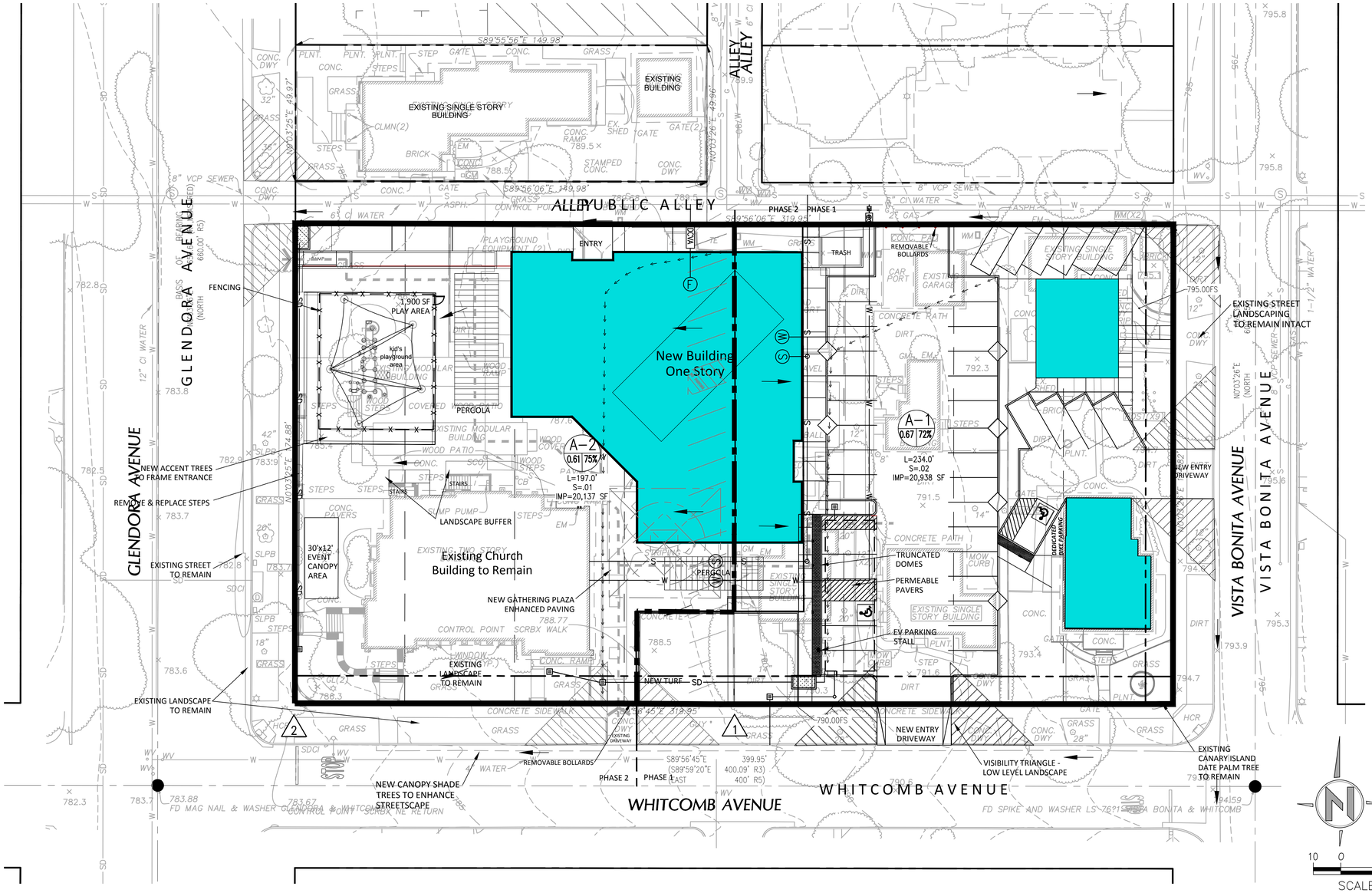
Input Parameters

Project Name	SBC_Prop
Subarea ID	A-2
Area (ac)	0.61
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8471
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.8268
Burned Peak Flow Rate (cfs)	0.8268
24-Hr Clear Runoff Volume (ac-ft)	0.105
24-Hr Clear Runoff Volume (cu-ft)	4571.9887





10 0 20 40

SCALE IN FEET
1 inch = 20 ft.

LEGEND

LEGEND	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	SD
NEW STORM DRAIN	SD
EXISTING CONTOUR	XXX
NEW CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
POINT OF COMPLIANCE	1
SUB-BASIN MARKER & AREA (AC)	A-1 / 0.81 / 90%
NODE/CONTOUR ELEVATION	313.00FL 310.00IE

BGW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BGW ARCHITECTS|2909 WASHINGTON BLVD - OGDEN, UT 84401|PH: 801-618-3463|www.BGWSERVICES.com

SEAL:
PROFESSIONAL ENGINEER
MICHAEL A. SLAWSON
No. C 58697
Exp. 12-31-20
CIVIL
REGISTERED
STATE OF CALIFORNIA

SHEET TITLE:

PROJECT: AC457 GLENDORA ORIGINAL ISSUE: 0/18

SHEET NUMBER:

DO NOT SCALE DRAWING

SECTION 7. STORMWATER QUALITY CONTROL MEASURES

7.1. Introduction

Stormwater quality control measures are required to augment site design principles and source control measures to reduce the volume of stormwater runoff and potential pollution loads in stormwater runoff to the maximum extent practicable. Stormwater quality control measures are designed to handle the frequent, smaller storm events, or the initial volume of stormwater runoff from larger storm events (typically referred to as first flush events). The first flush of larger storm events is the initial period of the storm where stormwater runoff typically carries the highest concentration and loads of pollutants. Small, frequent storm events represent most of the total annual average precipitation in the County.

The LID Ordinance requires that all Designated Projects retain the SWQDv on-site using retention-based stormwater quality control measures (infiltration and/or stormwater runoff harvest and use). The County also requires that Large-Scale Non-Designated Projects retain the ΔSWQDv on-site.

The following sections describe the procedure for selecting and implementing stormwater quality control measures, determining technical infeasibility with the on-site retention requirement, and implementing alternative compliance measures in situations where it is not feasible to meet the on-site retention requirement.

7.2. Stormwater Quality Control Measures

The stormwater quality control measures included in the LID Standards Manual are common non-proprietary control measures being implemented nationwide. The focus of the design criteria for stormwater quality control measures is the construction and implementation of stormwater quality control measures that meet stormwater runoff requirements in terms of on-site retention and pollutant removal. Projects must design and implement stormwater quality control measures that can handle the SWQDv or ΔSWQDv, and stormwater runoff in excess of this volume must be diverted around the stormwater quality control measures to prevent overloading.

The stormwater quality control measures in the LID Standards Manual are categorized into the following types:

- Retention-based stormwater quality control measures (RET-1 to RET-7);
- Biofiltration (BIO-1);
- Vegetation-based stormwater quality control measures (VEG-1 to VEG-4); and
- Treatment-based stormwater quality control measures (T-1 to T-6).

In general, all proposed projects must maximize on-site retention of the SWQDv or ΔSWQDv through infiltration and/or bioretention. If it is not feasible to fully infiltrate or use bioretention to handle the SWQDv or ΔSWQDv, stormwater runoff harvest and use is the next preferred control measure. Project applicants must verify requirements for stormwater runoff harvest and use with the California Department of Public Health. However, stormwater runoff harvest and use may not be feasible at all project locations.

For Designated Projects that are unable to fully retain the SWQDv on-site through retention-based stormwater quality control measures, alternative compliance measures (e.g., on-site biofiltration, off-site groundwater replenishment, off-site infiltration and/or bioretention, and off-site retrofit) must be implemented. Prior to off-site mitigation, the portion of the SWQDv that cannot be reliably retained on-site must be treated to meet effluent quality standards (see Section 7.4).

For Large-Scale Non-Designated Projects that cannot fully retain the ΔSWQDv on-site through retention-based stormwater quality control measures, water conservation measures that incorporate vegetation to promote pollutant removal and stormwater runoff volume reduction, integrate multiple uses, and/or promote percolation of stormwater runoff through soil media and allow it to discharge downstream slowly must be implemented. Any portion of the ΔSWQDv that will be discharged off-site must be treated. If the Director of Public Works determines that compliance with water conservation requirements is technically infeasible, in whole or in part, in response to a project applicant's submittal, the Director of Public Works will require that the project applicant submit, for approval by the Director of Public Works, a proposal that incorporates design features demonstrating compliance with LID requirements to the maximum extent practicable.

Various factors must be considered when selecting stormwater quality control measures. In addition to retaining stormwater runoff on-site or treating it to reduce target pollutants of concern, site considerations such as size of the drainage area, depth between the groundwater table and stormwater quality control measure, soil type and permeability, site slope, hydraulic head, size of stormwater quality control measure, and need for vegetation irrigation are important factors in selecting the appropriate stormwater quality control measure for a project site. Land requirements and costs to design, construct, and maintain stormwater quality control measures vary by type. Vector breeding considerations must also be addressed in selecting stormwater quality control measures because of the potential for nuisance and human health effects. General guidelines for selecting stormwater quality control measures are presented in Table 7-1.

Other Considerations for Designing Stormwater Quality Control Measures

Pretreatment Considerations

Pretreatment must be provided for stormwater quality control measures whose function may be adversely affected by sediment or other pollutants. Pretreatment may also be provided to facilitate the routine removal of sediment, trash, and debris, and to increase

the longevity of downstream stormwater quality control measures. Typical pretreatment options include presettling basins or forebays (small detention basins), vegetated swales, vegetated filter strips, hydrodynamic separators, oil/water separators, and catch basin inserts.

Retention-based Stormwater Quality Control Measures

Infiltration is the primary mechanism for reducing stormwater runoff for all retention-based stormwater quality control measures with the exception of stormwater runoff harvest and use. Soils should have sufficient organic content and sorption capacity to remove certain pollutants, but must be coarse enough to allow infiltration of stormwater runoff in a reasonable amount of time (e.g., less than 96 hours for above-ground ponded water to prevent vector breeding). Examples of suitable soils for infiltration are silty and sandy loams. Coarser soils, such as gravelly sands, have limited organic content and high permeability and therefore present a potential risk to groundwater from certain pollutants, especially in areas of shallow groundwater. The project applicant should consult with LACDPW to identify if vulnerable unconfined aquifers are located beneath the project site to determine if retention-based stormwater quality control measures are appropriate for the proposed project. In areas with unconfined aquifers, implementation of retention-based stormwater quality control measures should include appropriate pretreatment to ensure that the groundwater is protected from pollutants of concern.

In high-risk areas (i.e., areas at or near service/retail gasoline outlets, truck stops, and heavy industrial sites), the appropriateness of implementing retention-based stormwater quality control measures must be evaluated. It may not be technically feasible to meet the on-site retention requirement if the project site is located in an area where pollutant mobilization is a documented concern. The site assessment must determine if the proposed infiltration area is isolated from the high-risk areas and there is little chance of spill migration. The site assessment should also determine if pretreatment can sufficiently address pollutants of concern (see Section 7.4).

Additionally, retention-based stormwater quality control measures must be sited with appropriate setbacks from slopes, potable wells, non-potable wells, drain fields, springs, and buildings foundations according to the most recent GMED Policy GS 200.1.

Table 7-1. General Guidelines for Stormwater Quality Control Measures

Stormwater Quality Control Measure	Tributary Area (acres) [1]	Infiltration Rate [2]		Maximum Slope [2]		Hydraulic Head [3]	Irrigation Required? [4]	Vector Control Frequency [3]	Maintenance Frequency [3]
		≥0.3 in/hr	Any	~ 0%	< 15%				
Retention-based Stormwater Quality Control Measures									
Bioretention (RET-1)	<10	X			X	M	Y	M	M
Infiltration Basin (RET-2)	<10	X			X	H	Y*	L	M
Infiltration Trench (RET-3)	<10	X			X	H	N	L	L
Dry Well (RET-4)	<10	X		X		H	N	L	M
Permeable Pavement without an Underdrain (RET-5)	<10	X		X		M	N	L	L
Rain Barrel/Cistern (RET-6)	<0.25	n/a		n/a		n/a	N	H	L
Green Roof (RET-7)	n/a	n/a		n/a		n/a	Y	L	M
Biofiltration									
Biofiltration (BIO-1)	<10		X		X	M	Y	M	M

Notes to Table 7-1:

Source: Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (2010) and City of Modesto Guidance Manual for Development Stormwater Quality Control Measures (2011).

[1] Stormwater quality control measures with a tributary area of 0.5 acres or more must be off-line unless otherwise approved by LACDPW.

[2] X = stormwater quality control measure is suitable for listed site condition. n/a = not applicable.

[3] H = High; M = Medium; L = Low. n/a = not applicable.

[4] Y = Yes; N = No; Y* = Yes if vegetated.

Table 7-1. General Guidelines for Stormwater Quality Control Measures (continued)

Stormwater Quality Control Measure	Tributary Area (acres) [1]	Infiltration Rate [12]		Maximum Slope [2]		Hydraulic Head [3]	Irrigation Required? [4]	Vector Control Frequency [3]	Maintenance Frequency [3]
		≥0.3 in/hr	Any	~ 0%	< 15%				
Vegetation-based Stormwater Quality Control Measures									
Stormwater Planter (VEG-1)	<10		X		X	M	Y	M	M
Tree-well Filter (VEG-2)	<10		X		X	M	Y	M	M
Vegetated Filter Strips (VEG-3)	<10		X		X	L	Y	L	L
Vegetated Swales (VEG-4)	<10		X		X	L	Y	L	L
Treatment-based Stormwater Quality Control Measures									
Sand Filters (T-1)	Varies		X	X		H	N	L	H
Constructed Wetlands (T-2)	≥10		X	X		L	Y	H	H
Extended Detention Basin (T-3)	≥10		X	X		L	Y*	M	M
Wet Pond (T-4)	≥10		X	X		L	Y*	H	M
Permeable Pavement with an Underdrain (T-5)	<10		X	X		M	N	L	L
Proprietary Devices (T-6)	Varies [5]								

Notes to Table 7-1:

Source: Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (2010) and City of Modesto Guidance Manual for Development Stormwater Quality Control Measures (2011).

[1] Stormwater quality control measures with a tributary area of 0.5 acres or more must be off-line unless otherwise approved by LACDPW.

[2] X = stormwater quality control measure is suitable for listed site condition. n/a = not applicable.

[3] H = High; M = Medium; L = Low. n/a = not applicable.

[4] Y = Yes; N = No; Y* = Yes if vegetated.

[5] Site constraints for proprietary devices will vary depending on the type of device proposed, design specifications, and manufacturer. Proprietary devices must be approved for use by LACDPW.

Biofiltration

Biofiltration systems use vegetation and soils or other filtration media to treat stormwater runoff. As stormwater runoff passes through the vegetation and the filtration media, the combined effects of filtration, adsorption, and biological uptake remove pollutants. In biofiltration systems, organic material in the soils retains water and promotes pollutant adsorption (i.e., dissolved metals, petroleum hydrocarbons) into the soil matrix. Plants use soil moisture, promote the drying of the soil through transpiration, and uptake pollutants in their roots and leaves. Plants with extensive root systems also help to maintain infiltration rates. Vegetation also decreases the velocity of flow and allows for particulates to settle. Biofiltration systems must be designed according to specifications outlined in the Biofiltration Fact Sheet (BIO-1) in Appendix E of the LID Standards Manual.

Vegetation-Based Stormwater Quality Control Measures

Vegetation-based stormwater quality control measures use the same principles as biofiltration, described above, to treat stormwater runoff. However, vegetation-based stormwater quality control measures are not subject to the design specifications outlined in Attachment H of the 2012 MS4 Permit.

Proprietary Stormwater Quality Control Measures

Proprietary stormwater quality control measures that are proposed for a project must be reviewed and approved by LACDPW. More information on a number of vendors of proprietary devices is provided at http://dpw.lacounty.gov/wmd/bmp/accepted_bmps.cfm.

7.3. Technical Infeasibility

In order to demonstrate technical infeasibility, the project applicant must show that the project cannot reliably retain 100 percent of the SWQDv on-site, even with the maximum application of green roofs and stormwater runoff harvest and use, and submit a site-specific hydrologic and/or design analysis conducted and verified by a registered professional engineer, geologist, architect, and/or landscape architect. Technical infeasibility for on-site infiltration may result from conditions including the following:

- The corrected in-situ infiltration rate is less than 0.3 inches per hour, as determined according to the most recent GMED Policy GS 200.1, and it is not technically feasible to amend the in-situ soils to attain an infiltration rate necessary to achieve reliable performance of retention-based stormwater quality control measures for the SWQDv on-site;
- Locations where the seasonal high groundwater level is within 10 feet of the surface, as determined according to the most recent GMED Policy GS 200.1;
- Locations within 100 feet of a groundwater well used for drinking water;

- Brownfield development sites where infiltration poses a risk of pollutant mobilization;
- Other locations where pollutant mobilization is a documented concern (e.g., at or near properties that are contaminated or store hazardous substances underground);
- Locations with potential geotechnical hazards;
- Smart growth and infill or redevelopment locations where the density and/or nature of the project would create significant difficulty for compliance with the on-site retention requirement;
- Locations where infiltration may adversely impact biological resources; or
- Locations where infiltration may cause health and safety concerns.

It may be technically infeasible for stormwater runoff harvest and use for the following situations:

- Projects that would not provide sufficient irrigation or (where permitted) domestic grey water demand for use of stored stormwater runoff due to limited landscaping or extensive use of low water use plant palettes in landscaped areas;
- Projects that are required to use recycled water for landscape irrigation;
- Projects in which the harvest and use of stormwater runoff would conflict with local, state, or federal ordinances or building codes;
- Locations where storage facilities may cause potential geotechnical hazards as outlined in the geotechnical report; or
- Locations where storage facilities may cause health and safety concerns.

7.4. Alternative Compliance

For Designated Projects where it is determined to be technically infeasible to reliably retain 100 percent of the SWQDv on-site, alternative compliance measures must be implemented. The project applicant must implement at least one of the following alternative compliance measures:

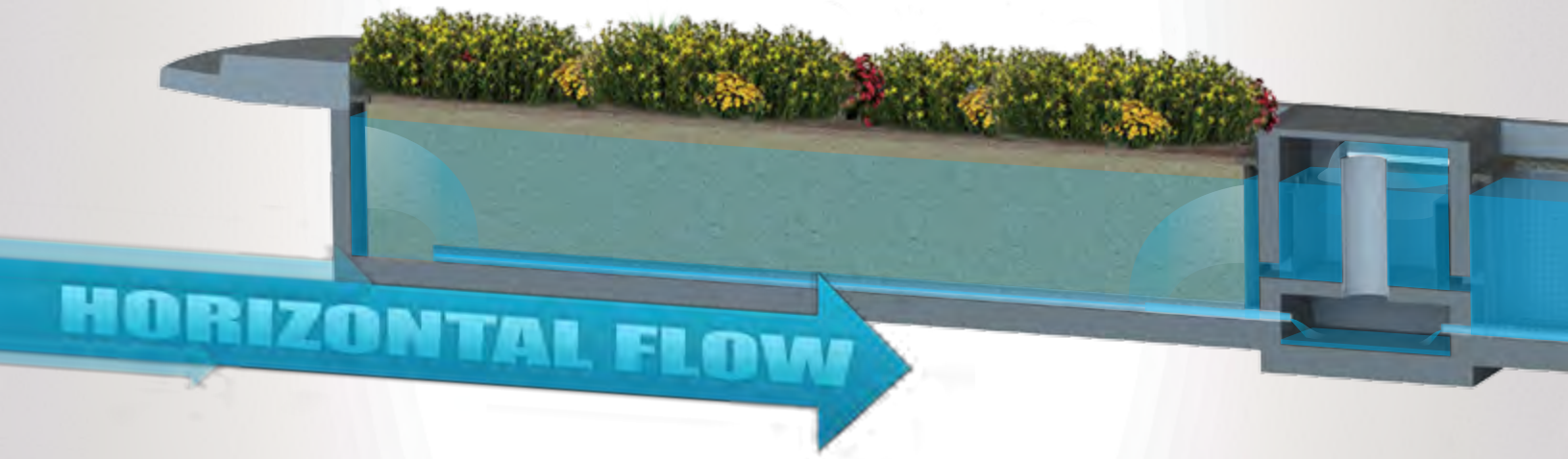
- On-site biofiltration of 1.5 times the volume of the SWQDv that is not reliably retained on-site;
- On-site treatment and off-site infiltration/bioretention of the volume of the SWQDv that is not reliably retained on-site;
- Replenishment of groundwater supplies that have a designated beneficial use in the *Water Quality Control Plan: Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan), which was most recently adopted in June 1994 by the Regional Water Board and subsequently amended; or

- On-site treatment and off-site infiltration/bioretention or stormwater runoff harvest and use of the volume of SWQDv that is not reliably retained on-site through retrofit an existing development with similar land uses as the project.

A flow chart outlining process for implementing alternative compliance measures is presented in Figure 7-1.

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



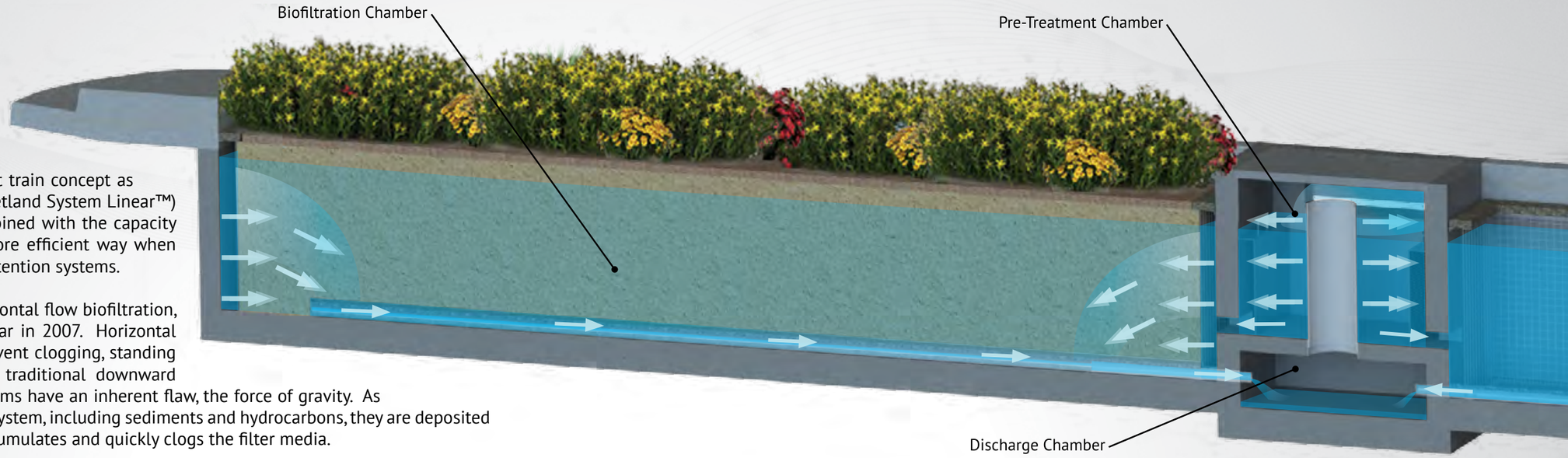
WetlandMod™

MODULAR WETLAND TREATMENT, VOLUME REDUCTION, REUSE & STORAGE SYSTEM

A NEW DIRECTION IN TRADITIONAL BIORETENTION / BIOFILTRATION SYSTEMS

Overview

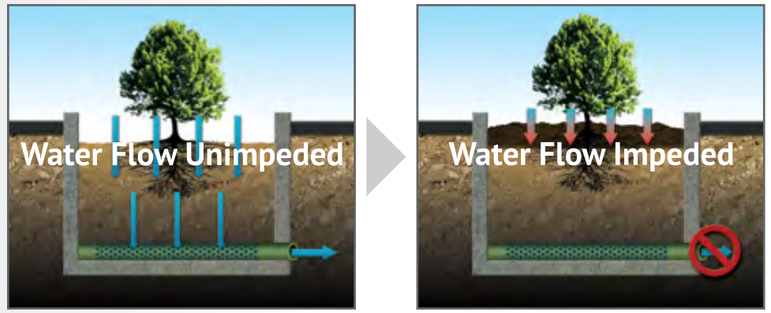
Modular Wetland Systems, Inc. continues to provide groundbreaking stormwater treatment and volume reduction/control technology with the **WetlandMod™**. This modular system provides the same treatment train concept as the industry leading MWS Linear (Modular Wetland System Linear™) - screening, separation, & biofiltration - combined with the capacity to reduce and control water volume in a more efficient way when compared to traditional downward flow bioretention systems.



The system is built upon the concept of horizontal flow biofiltration, which was first introduced by the MWS Linear in 2007. Horizontal flow works with gravity, not against it, to prevent clogging, standing water and other problems associated with traditional downward flow bioretention systems. Bioretention systems have an inherent flaw, the force of gravity. As stormwater runoff carries pollutants into the system, including sediments and hydrocarbons, they are deposited on top of the bioretention media where it accumulates and quickly clogs the filter media.

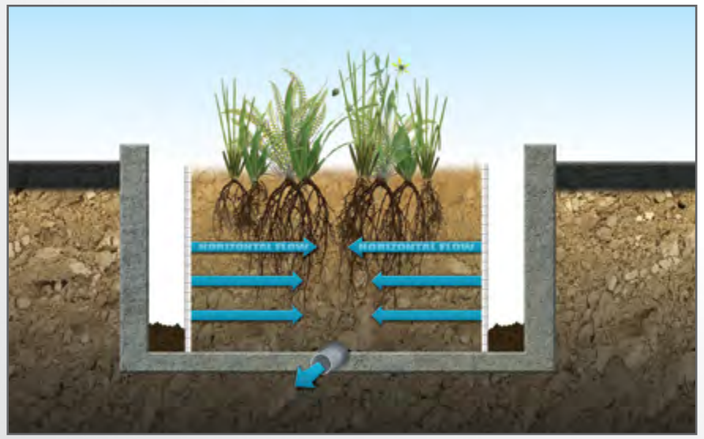
It has been documented that sediment accumulation from just a few storm events can completely clog a bioretention system. This leads to drastically reduced infiltration rates, expensive maintenance burdens, and safety issues associated with standing water, depressed landscaping and vector control.

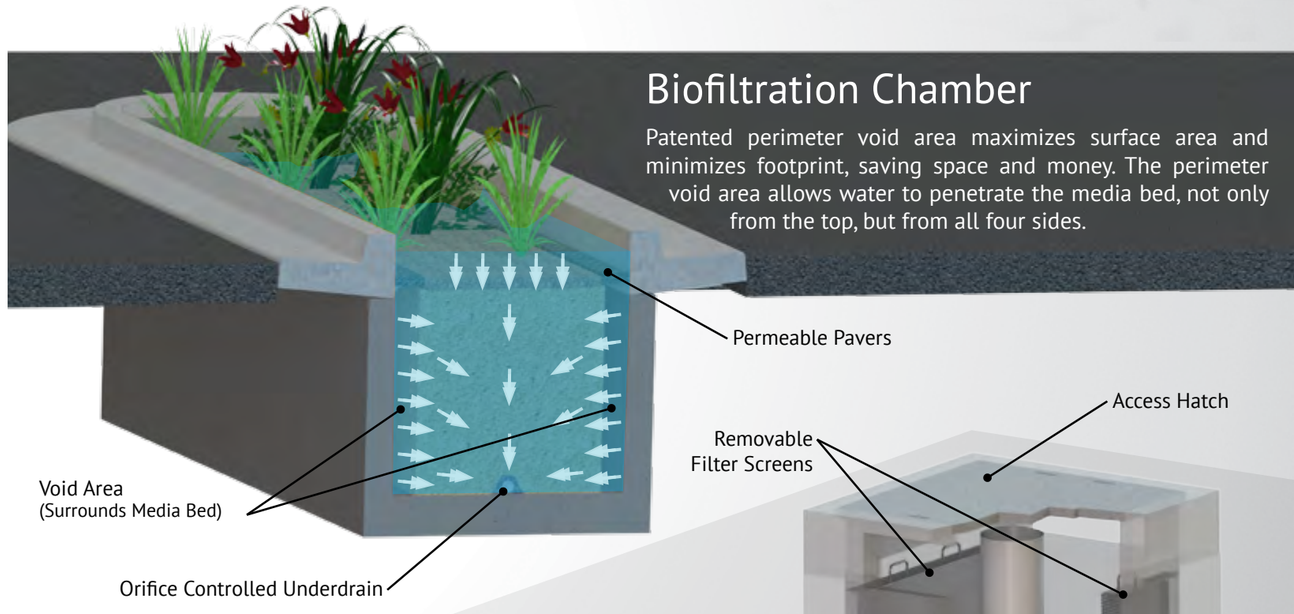
Downward Flow



Sediments Accumulate on Top of the Media Leading to Clogging

The **WetlandMod™** overcomes these challenges by utilizing pre-treatment, a horizontal flow biofiltration bed, and orifice flow control. The initial surface of the media bed in the **WetlandMod™** is oriented on a vertical plane, as opposed to horizontally, therefore running parallel with the force of gravity as opposed to perpendicular. This simple concept, increases surface area, reduces BMP footprint, prevents clogging and leads to an enhanced overall system with lower maintenance costs. The **WetlandMod™** can utilize various blends to meet local stormwater bioretention media specifications. The system is also available with an organic-free WetlandMEDIA to prevent nutrient leaching and maximize pollutant removal.

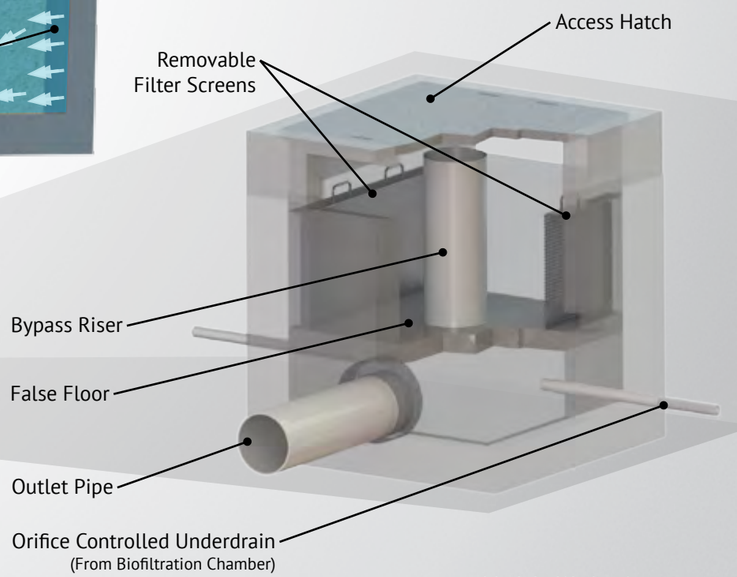




Biofiltration Chamber

Patented perimeter void area maximizes surface area and minimizes footprint, saving space and money. The perimeter void area allows water to penetrate the media bed, not only from the top, but from all four sides.

Pre-Treatment & Discharge Chamber



Configuration

One of the biggest challenges of the implementation of LID and bioretention/biofiltration systems is the associated space requirements. The large space requirements of traditional bioretention systems can cause design and feasibility issues, increasing the overall cost to comply with local and state stormwater regulations.

The **WetlandMod™** marks the first technological breakthrough to address how we comply with these regulations. The goal of the system is to minimize footprint and land costs associated with traditional bioretention/ biofiltration systems. This is acheived by utilizing horizontal flow technology and combining it with traditional downward flow, therefore maximizing the surface area for a given footprint.

Designed To Minimize Required BMP Footprint and Maximize Buildable Space

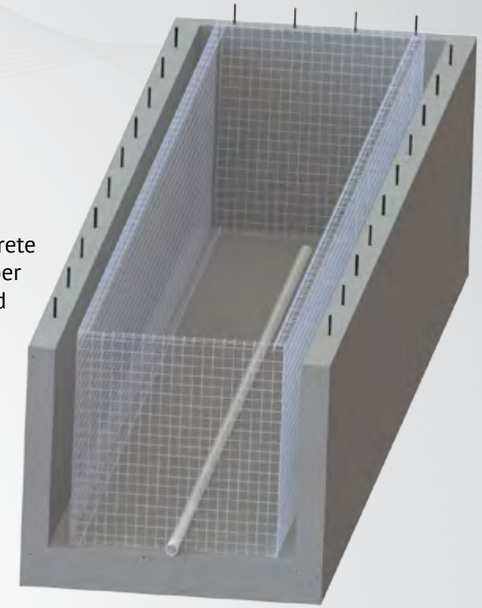
This system is constructed from modular precast concrete structures. The system comes standard with a curb-type pre-treatment structure, including internal bypass. The biofiltration chambers can be made in any length and shape (shown below) to allow for easy integration with parking lot island designs. The system comes in two standard widths, 4 feet (18" minimum media requirement - San Diego County) and 5 feet (24" minimum media requirement - Los Angeles County).

Footprint Reduction Up To 61% Over Traditional Bioretention Systems

(Example: Planter Boxes, Rain Gardens, Biofiltration)

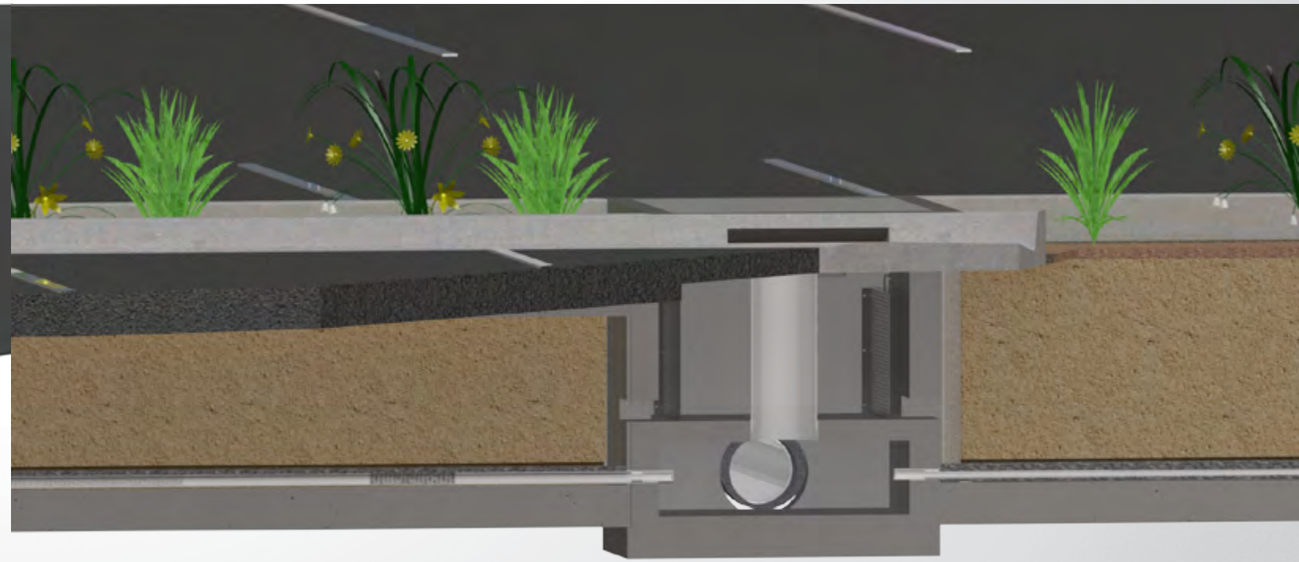
Wetland Chamber Module

The *Wetland Chamber Module* is constructed of precast concrete and available in various lengths and heights. The chamber also includes rebar dowels to attach structure to curb and gutter. Units can be connected mechanically end-to-end for longer modules.



Pre-Treatment Chamber Module

Pre-treatment Chambers come standard with built-in curb inlets to intercept sheet flows from surrounding areas. The pre-treatment chamber is available with an optional internal bypass for high flows and it is easily accessible for quick maintenance. Trash, debris and sediments are isolated in a central location, minimizing maintenance requirements on the biofiltration chamber.

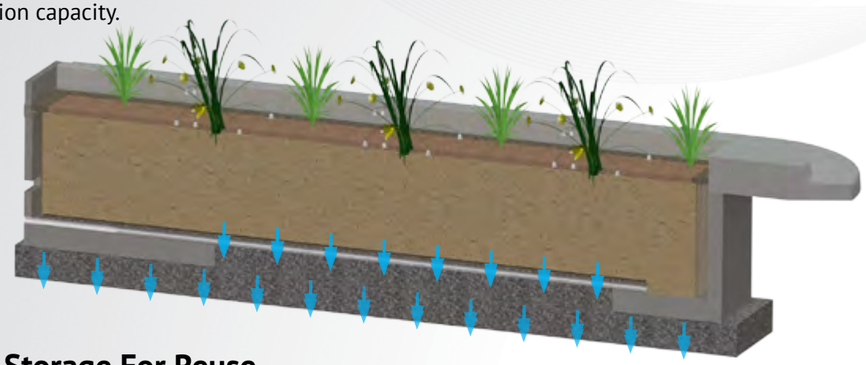


Curb Inlet

Configurations

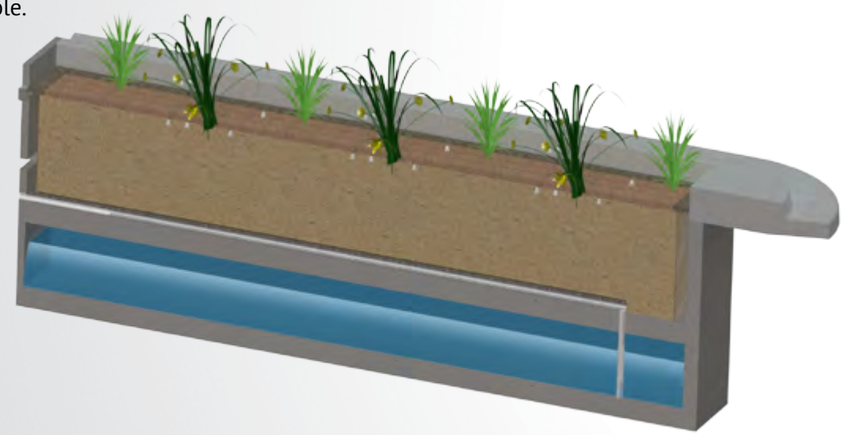
Open Bottom - Infiltration

This configuration is available with an open basin to maximize infiltration and meet "partial infiltration" requirements in many jurisdictions. A 12" rock base is recommended under the structure to maximize storage and infiltration capacity.



Cistern - Storage For Reuse

An optional storage vessel under the biofiltration chamber stores water for reuse, including irrigation and grey water. The *Cistern* configuration allows for treated runoff to be stored for later use and a removable sump pump is available.



WetlandMEDIA

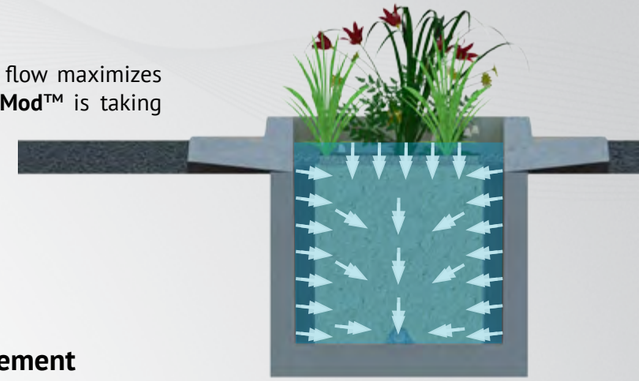
WetlandMEDIA is an organic free alternative to traditional bioretention media. It offers higher infiltration rates and a sorptive media mix with high ion exchange capacity. This makes it ideal for nutrient removal. WetlandMEDIA also supports robust vegetation and prevents standing water.

Bioretention Mix

The **WetlandMod™** is designed to utilize any type of bioretention mix required to meet local requirements and specifications, including a *5-Inch Per Hour* sand compost mix found in most LID manuals.

Sizing

The combination of horizontal flow and downward flow maximizes surface area and minimizes footprint. The **WetlandMod™** is taking bioretention/biofiltration to a new level.



18" Media - San Diego County Minimum Requirement

18" Media Thickness	WetlandMod	Traditional Bioretention
Chamber Width I.D. (ft.)	4.00	4.00
Cage Width (ft.)	3.34	n/a
Void Width (ft.)	0.33	n/a
Chamber Height Max (TC) (ft.)	4.40	n/a
Assoc. Cage Height Max (ft.)	3.52	n/a
TC to Top of Cage Distance (ft.)	0.88	n/a
Ponding Over Media (ft.)	0.33	Variable
Chamber Height Min (ft.)	1.61	Variable
Assoc. Cage Height Min (ft.)	1.83	Variable
TC to Top of Cage Distance (ft.)	0.88	Variable
MAX Surface Area Per Linear Foot (sq. ft.)	**10.38**	**4**
Footprint Reduction Provided	**61%**	
MIN Surface Area Per Linear Foot (sq. ft.)	**7**	**4**
Footprint Reduction Provided	**43%**	

24" Media - Los Angeles County Minimum Requirement

24" Media Thickness	WetlandMod	Traditional Bioretention
Chamber Width I.D. (ft.)	5.00	5.00
Cage Width (ft.)	4.34	n/a
Void Width (ft.)	0.33	n/a
Chamber Height Max (TC) (ft.)	4.40	n/a
Assoc. Cage Height Max (ft.)	3.52	n/a
TC to Top of Cage Distance (ft.)	0.88	n/a
Ponding Over Media (ft.)	0.33	Variable
Chamber Height Min (ft.)	2.05	Variable
Assoc. Cage Height Min (ft.)	2.33	Variable
TC to Top of Cage Distance (ft.)	0.88	Variable
MAX Surface Area Per Linear Foot (sq. ft.)	**11.38**	**5**
Footprint Reduction Provided	**56%**	
MIN Surface Area Per Linear Foot (sq. ft.)	**9**	**5**
Footprint Reduction Provided	**44%**	

Attachment B

Geotechnical Investigation

[Include all geotechnical documents relevant to infiltration feasibility (i.e. Geotechnical Report, Soils Report, Percolation Report, Soils Letter, etc.). The document(s) must detail the results of the soil investigation, the infiltration rate, groundwater depths, soil characterization, etc. Note that soil borings must be conducted in the area of the proposed BMPs. In addition to the complete soils report, a letter signed and stamped with wet ink application by a geotechnical engineer must be provided. The letter must state that the soil will or will not exhibit instability as a result of implementing the proposed BMPs, that the seasonal high groundwater depth is or is not at the required depth (5-10 feet depending on BMP type) below the base of the infiltration BMP, and the infiltration rate is or is not at least 0.3 in/hr.]

NOT APPLICABLE - PRELIMINARY SUBMITTAL

Attachment C
City Forms

Attachment D

Master Covenant Agreement (MCA)

Include a Master Covenant Agreement (MCA) form along with an attached Operations and Maintenance (O&M) Plan, Site Plan, and Owner's Certification. The MCA must list the type and dimensions of each BMP. Once the MCA is approved by the City, it will need to be notarized and recorded (along with attachments) with the County Recorder's Office.

NOT APPLICABLE - PRELIMINARY SUBMITTAL

Attachment E

Operations and Maintenance (O&M) Plan

[Include an Operations and Maintenance (O&M) Plan. This should include the components of the BMPs, the frequency of inspections and maintenance, the responsible entity, etc.

NOT APPLICABLE - PRELIMINARY SUBMITTAL

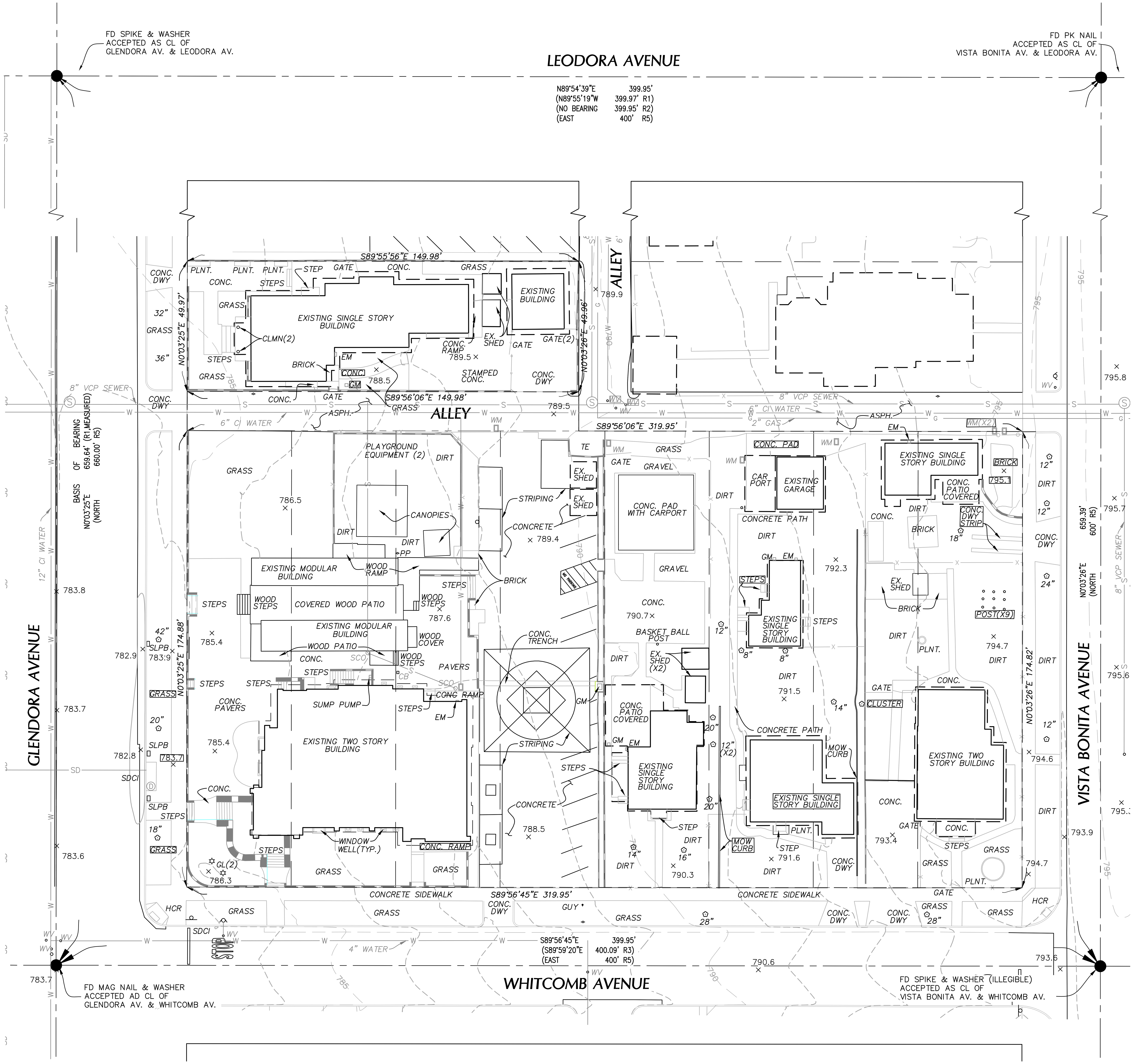
OPERATIONS AND MAINTENANCE (O&M) PLAN

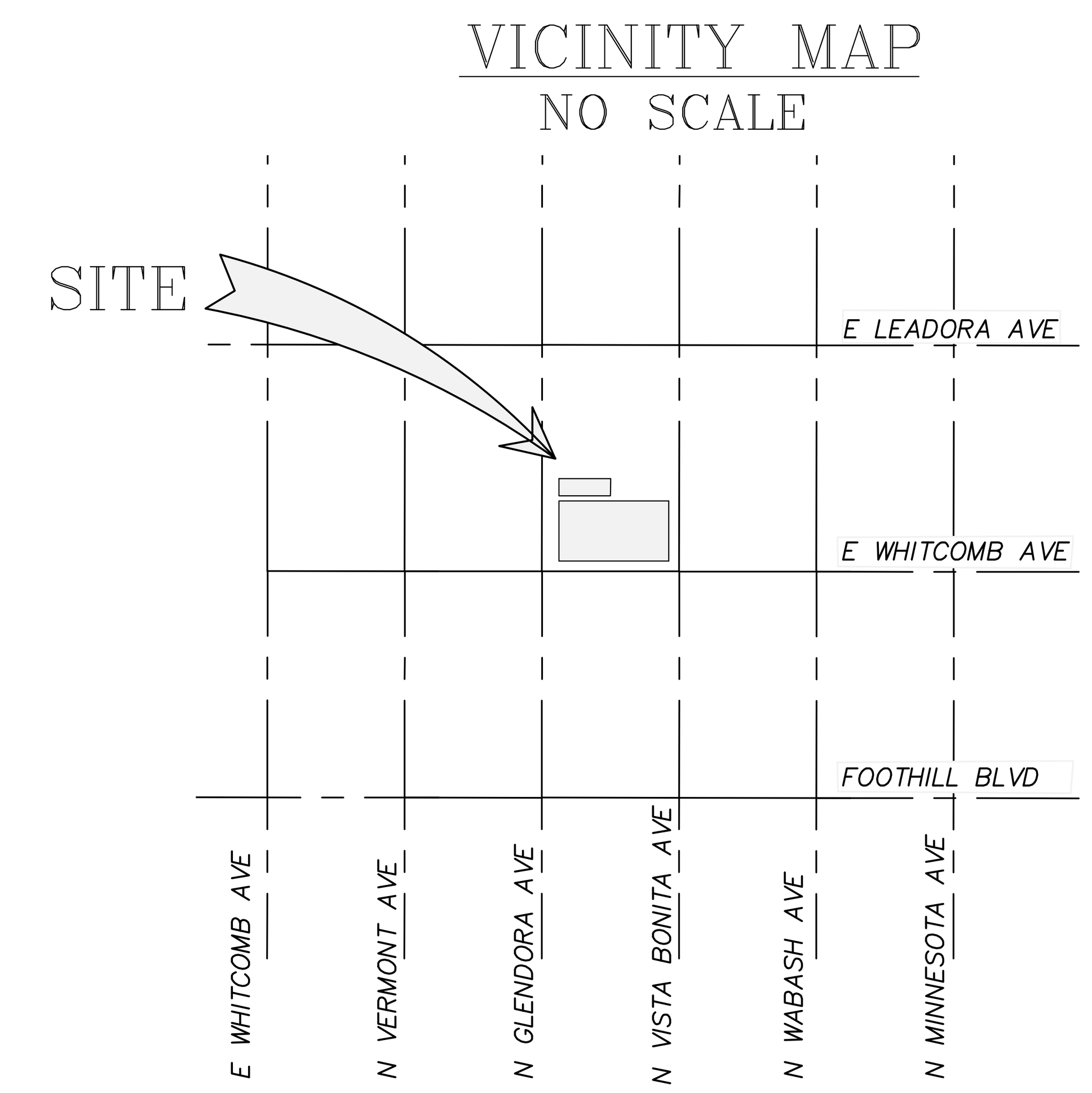
FOR

Attachment F

Plans

[Include full sized copies (24" x 36" or larger) of all relevant plans (i.e. grading plans, plumbing plans, drainage plans, etc.) signed, stamped, and dated with wet ink application by a California licensed civil engineer with all water quality notes and details. This is to properly evaluate the site design and ensure all BMPs are located on plans which will be used by the contractor during construction. The plans must indicate the locations of all BMPs, cross-sectional details of all BMPs, conveyance systems, drainage connections, overflow processes, elevations, inverts, etc. All conveyance systems (i.e. ribbon gutters, area drains, storm drains, swales, etc.) must be indicated with inverts and elevations. The cross-sectional details of the BMPs must show the type and depth of all layers (i.e. amended soil layer, gravel layer, etc.) and must follow the criteria from the design standard used.]





LEGAL DESCRIPTION

LOTS 15, 17 THROUGH 24, IN BLOCK 'N' OF THE MAP OF THE TOWN OF GLENDORA, IN THE CITY OF GLENDORA, COUNTY OF LOS ANGELES, STATE OF CALIFORNIA AS PER MAP RECORDED IN BOOK 15 PAGE 27 OF MISCELLANEOUS RECORDS IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS N0°03'25"E BETWEEN FOUND MONUMENTS, ACCEPTED AS THE CENTERLINE OF GLENDORA AVE., AS SHOWN ON THE CITY OF GLENDORA DEPARTMENT OF ENGINEERING CENTERLINE TIE SHEET NUMBER (NW-52), REVISED OCTOBER 1968.

BENCH MARK

THE BENCH MARK USED FOR THIS MAP IS, BENCHMARK #29 IN THE NORTH CURB OF LEADORA AVENUE 56 FEET WEST OF THE CENTERLINE OF GLENDORA AVENUE, AS PUBLISHED IN THE CITY OF GLENDORA VERTICAL CONTROL BOOK. ELEVATION = 791.97' (1963 ADJUSTMENT)

REFERENCE TABLE

R1: CITY OF GLENDORA CENTERLINE TIE SHEET NW-52
R2: CITY OF GLENDORA CENTERLINE TIE SHEET PWFB 1632 PAGE 868
R3: CORNER RECORD 1123
R4: CITY OF GLENDORA CENTERLINE TIE SHEET PWFB 1632 PAGE 915
R5: MAP OF THE TOWN OF GLENDORA, BOOK 15 PAGE 27

N

20 10 0 020 40 60

SCALE IN FEET
1 INCH = 20 FT.

BWE
CIVIL•STRUCTURAL•SURVEY•PLANNING
9449 BALBOA AVE, STE 270
SAN DIEGO, CA 92123 619.299.5550

LEGEND

UTILITIES

ELECTRIC METER . . . . EM

STORM DRAIN MANHOLE . . . . SDMH
CATCH BASIN. . . . . CB
STORM DRAIN LINE . . . . SD

WATER METER . . . . WM
WATER VALVE . . . . WV
FIRE HYDRANT . . . . FH

GAS METER . . . . GM
GAS VALVE . . . . GV

SEWER MANHOLE . . . . SMH
SEWER CLEAN OUT . . . . SCO
SEWER LINE . . . . S

LANDSCAPING

DECIDUOUS TREE . . . .
TREE CANOPY/SCHRUBS . . . .

PROPERTY DATA

PROPERTY LINE . . . .
CENTER LINE . . . .

IMPROVEMENTS

WROUGHT IRON FENCE . . . .
CHAIN LINK FENCE . . . .
WOOD FENCE . . . .
WALL . . . .
ASPHALT . . . . ASPH
CONCRETE . . . . CONC
CURB & GUTTER . . . .
BUILDING FOOTPRINT . . . .
SIGN . . . .

ABBREVIATIONS

SIDEWALK	SWK
HANDICAPPED RAMP	HCR
HANDICAPPED	HC
TRASH ENCLOSURE	TE
COLUMN	CLM
DRIVEWAY	DWY
ENCLOSURE	ENCL
BACK OF WALL	BW
LIGHT POLE.	LP
POLYVINYL CHLORIDE PIPE	P.V.C.
PLANTER	PNTR

MONUMENTS

FOUND MONUMENT AS NOTED . . . . ●
INDICATES RECORD DATA PER RECORD TABLE . . . . ( )

BGW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BGW ARCHITECTS | 2909 WASHINGTON BLVD - OGDEN, UT 84401 | PH: 801-618-3463 | www.BGWSERVICES.com

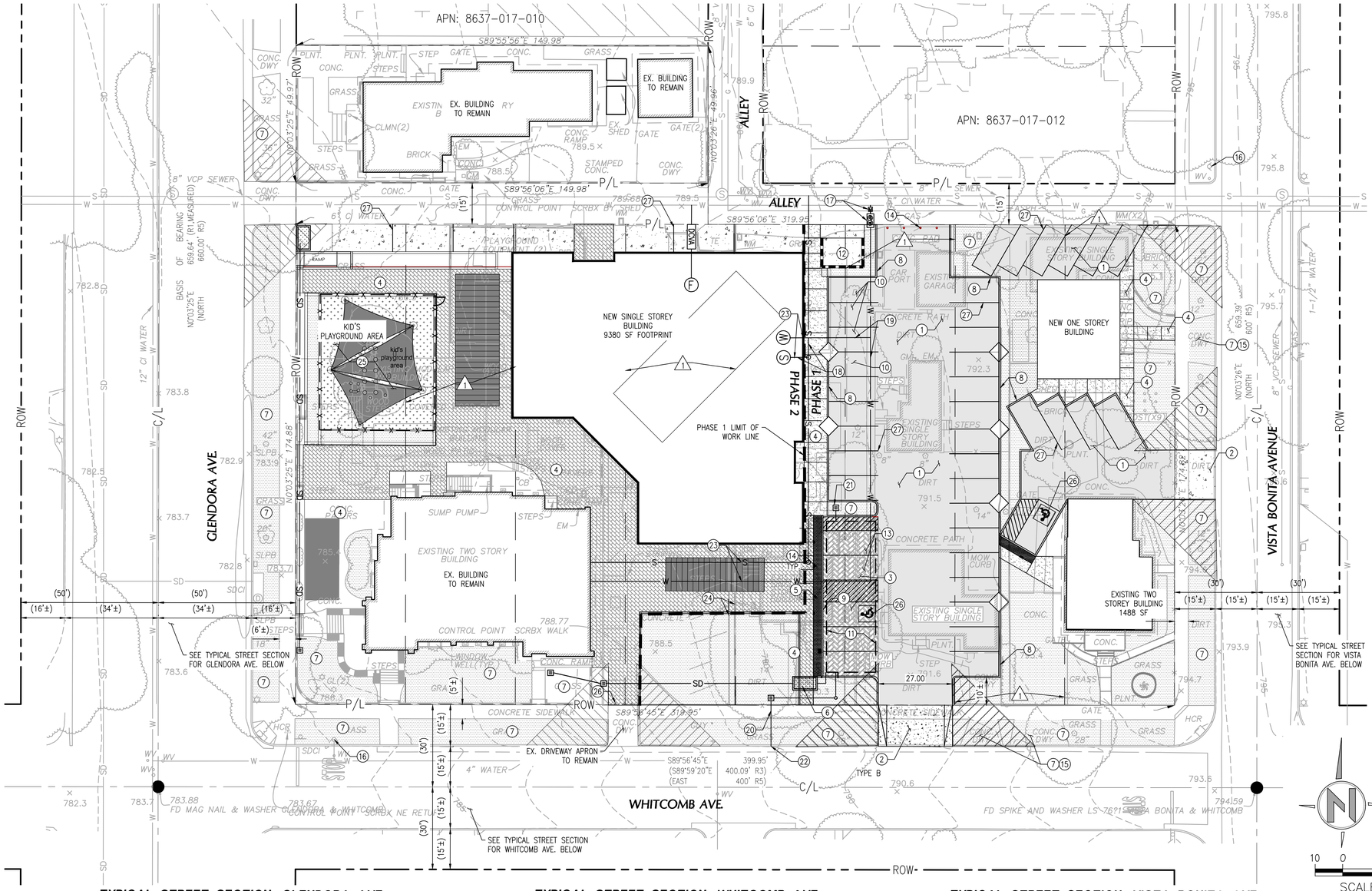
SEAL:
REGISTERED PROFESSIONAL ENGINEER
MICHAEL A. SLAWSON
No. C 056127
Exp. 12-31-20
CIVIL
STATE OF CALIFORNIA

SHEET TITLE:
EXISTING CONDITIONS PLAN

PROJECT: AC457 GLENDORA ORIGINAL ISSUE: CUP

SHEET NUMBER:
C-0.1

DO NOT SCALE DRAWING



LEGEND

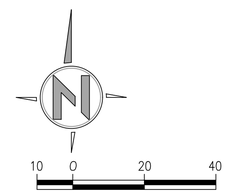
- PROPERTY LINE/RIGHT-OF-WAY ——P/L—— ——ROW——
- CENTER LINE ——C/L——
- LOT LINE
- PHASE 1 LIMIT OF WORK LINE
- AC PAVEMENT
- CONCRETE PAVEMENT
- SITE TRIANGLE
- ENHANCED CONCRETE PAVEMENT
- PERMEABLE PAVERS
- TRUNCATED DOMES
- LANDSCAPE AREA
- MODULAR WETLAND OR EQUAL
- NEW STORM LINE ——SD——
- NEW DOMESTIC WATER SERVICE ——W——
- NEW PRIVATE SEWER LATERAL ——S——
- NEW TRASH ENCLOSURE WALL
- NEW CATCH BASIN

CONSTRUCTION NOTES

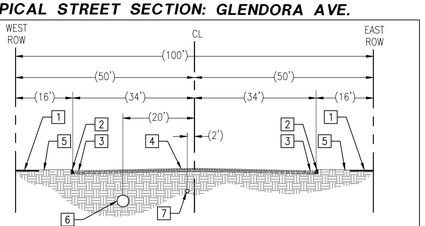
1. NEW ASPHALT CONCRETE PAVEMENT
2. NEW COMMERCIAL DRIVEWAY PER CITY OF GLENDORA DWG 1.13
3. NEW PERMEABLE PAVERS
4. NEW ENHANCED CONCRETE PAVEMENT. PATTERN/FINISH PER LANDSCAPE PLANS
5. NEW TRUNCATED DOMES
6. NEW MODULAR WETLAND OR EQUAL
7. NEW LANDSCAPED AREA
8. NEW 6" CURB
9. NEW 0" CURB
10. CARPOOL PARKING PER ARCH PLAN
11. NEW UNDERGROUND STORMWATER DETENTION/RETENTION SYSTEM
12. RELOCATED TRASH ENCLOSURE AND CONC. PAD PER ARCH PLAN
13. NEW EV PARKING STALLS PER ARCH PLAN
14. NEW REMOVABLE BOLLARDS
15. EX. DRIVEWAY APRON TO BE REMOVED
16. EX. HYDRANT
17. NEW DOMESTIC WATER METER & BACKFLOW PREVENTION DEVICE TO SERVE NEW BUILDINGS
18. NEW PRIVATE SEWER LATERAL
19. NEW DOMESTIC WATER SERVICE
20. NEW STORM PIPE
22. OVERFLOW PARKWAY DRAIN PER CITY OF GLENDORA DWG 1.12
23. STUB FOR FUTURE CONNECTION
24. EX. SCREEN WALL & PLANTER TO REMAIN IN PHASE 1
25. NEW PLAYGROUND AREA & SURFACING PER LANDSCAPE PLANS
26. ADA PARKING STALLS PER ARCH PLAN
27. STRIPING PER ARCH PLAN

MAPPING NOTES

1. EX. LOT LINE PER TENTATIVE PARCEL MAP 74655. LOTS TO BE MERGED PER FUTURE PARCEL MAP (PROCESSING CONCURRENTLY)



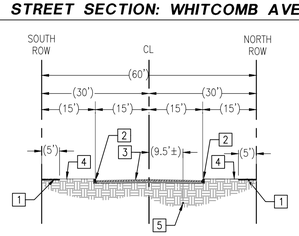
TYPICAL STREET SECTION: GLENDORA AVE.



GLENDORA AVENUE NOTES	DEPTH (APPROX.):	REFERENCE DRAWINGS:
1 CONCRETE SIDEWALK		
2 6" CONCRETE CURB		
3 BRICK GUTTER		
4 AC PAVEMENT		
5 LANDSCAPE AREA		
6 EX. STORM DRAIN	UNKNOWN	FIELD OBSERVATION
7 12" C.I. WATER	~3.5'	WATER ATLAS MAP 120

** ALL DIMENSIONS AND DEPTHS ARE APPROXIMATE. CONTRACTOR TO VERIFY IN FIELD**

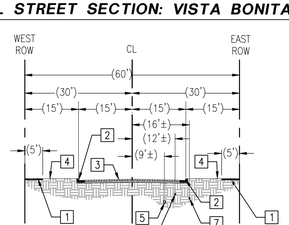
TYPICAL STREET SECTION: WHITCOMB AVE.



WHITCOMB AVENUE NOTES	DEPTH (APPROX.):	REFERENCE DRAWINGS:
1 CONCRETE SIDEWALK		
2 6" CONCRETE CURB		
3 AC PAVEMENT		
4 LANDSCAPE AREA		
5 4" STL WATER	~3.5'	WATER ATLAS MAP 120

** ALL DIMENSIONS AND DEPTHS ARE APPROXIMATE. CONTRACTOR TO VERIFY IN FIELD**

TYPICAL STREET SECTION: VISTA BONITA AVE.



VISTA BONITA AVENUE NOTES	DEPTH (APPROX.):	REFERENCE DRAWINGS:
1 CONCRETE SIDEWALK		
2 6" CONCRETE CURB & GUTTER		
3 AC PAVEMENT		
4 LANDSCAPE AREA		
5 8" VCP SEWER (WHERE OCCURS)	UNKNOWN	DWG# 2692-S
6 2" GAS (WHERE OCCURS)	~2.5'	DWG# 2692-S
7 1-1/2" STL WATER (WHERE OCCURS)	~3.0'	WATER ATLAS MAP 120

** ALL DIMENSIONS AND DEPTHS ARE APPROXIMATE. CONTRACTOR TO VERIFY IN FIELD**

BGW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

BGW ARCHITECTS | 2999 WASHINGTON BLVD - OGDEN, UT 84401 | PH: 801-618-3463 | www.BGWSERVICES.com

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

SEAL:
REGISTERED PROFESSIONAL ENGINEER
MICHAEL A. SLAWSON
No. C 058827
Exp. 12-31-20
CIVIL
STATE OF CALIFORNIA

BVE
CIVIL•STRUCTURAL•SURVEY•PLANNING
9449 BALBOA AVE. STE 270
SAN DIEGO, CA 92123 619.299.5550

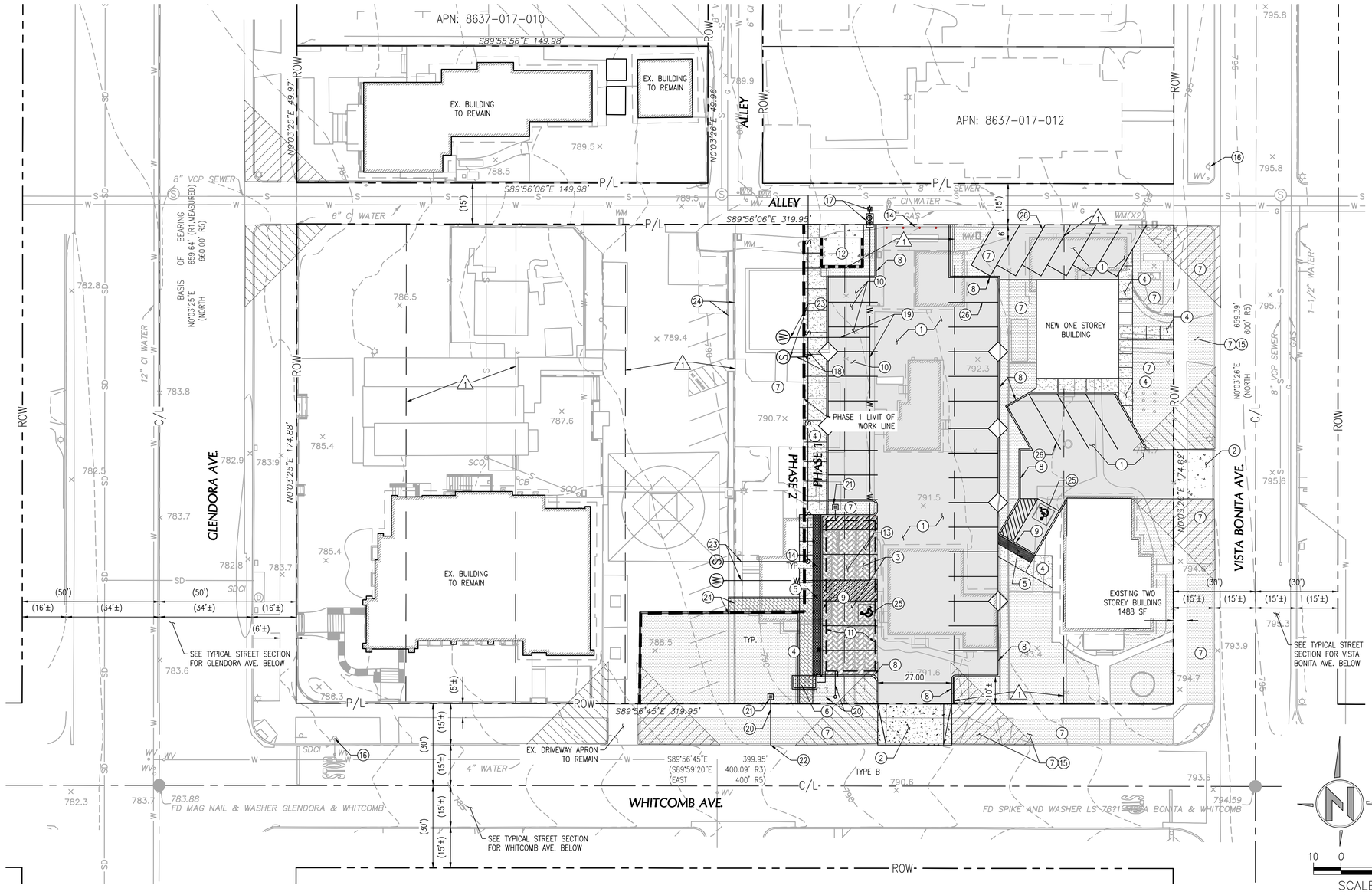
SHEET TITLE:
CIVIL SITE MASTER PLAN PHASE 1 & 2

PROJECT: AC457 GLENDORA ORIGINAL ISSUE: 10-25-19

SHEET NUMBER:
C-1.0

DO NOT SCALE DRAWING

PLOT: M:\PROJECTS\12500\12605US.2.00 CORNERSTONE BIBLE CHURCH\DWGS\SHEET_DWGS\CivP\12605 GRAD MASTER PLAN.DWG Denise Alkema 8/27/2020 3:59 PM



LEGEND

- PROPERTY LINE/RIGHT-OF-WAY . . . . . P/L, ROW
- CENTER LINE . . . . . C/L
- LOT LINE
- PHASE 1 LIMIT OF WORK LINE
- AC PAVEMENT
- CONCRETE PAVEMENT
- SITE TRIANGLE
- ENHANCED CONCRETE PAVEMENT
- PERMEABLE PAVERS
- TRUNCATED DOMES
- LANDSCAPE AREA
- MODULAR WETLAND OR EQUAL
- NEW STORM LINE . . . . . SD
- NEW DOMESTIC WATER SERVICE . . . . . W
- NEW PRIVATE SEWER LATERAL . . . . . S
- NEW TRASH ENCLOSURE WALL
- NEW CATCH BASIN

CONSTRUCTION NOTES

1. NEW ASPHALT CONCRETE PAVEMENT
2. NEW COMMERCIAL DRIVEWAY PER CITY OF GLENDORA DWG 1.13
3. NEW PERMEABLE PAVERS
4. NEW ENHANCED CONCRETE PAVEMENT. PATTERN/FINISH PER LANDSCAPE PLANS
5. NEW TRUNCATED DOMES
6. NEW MODULAR WETLAND OR EQUAL
7. NEW LANDSCAPED AREA
8. NEW 6" CURB
9. NEW 0" CURB
10. CARPOOL PARKING PER ARCH PLAN
11. NEW UNDERGROUND STORMWATER DETENTION/RETENTION SYSTEM
12. RELOCATED TRASH ENCLOSURE AND CONC. PAD PER ARCH PLAN
13. NEW WHEELSTOP
14. REMOVABLE BOLLARDS
15. EX. DRIVEWAY APRON TO BE REMOVED
16. EX. HYDRANT
17. NEW DOMESTIC WATER METER & BACKFLOW PREVENTION DEVICE TO SERVE NEW BUILDINGS
18. NEW PRIVATE SEWER LATERAL
19. NEW DOMESTIC WATER SERVICE
20. NEW STORM PIPE
21. NEW CATCH BASIN
22. OVERFLOW PARKWAY DRAIN PER CITY OF GLENDORA DWG 1.12
23. STUB FOR FUTURE CONNECTION
24. EX. SCREEN WALL & PLANTER TO REMAIN IN PHASE 1
25. ADA PARKING STALLS PER ARCH PLAN
26. STRIPING PER ARCH PLAN

MAPPING NOTES

1. EX. LOT LINE PER TENTATIVE PARCEL MAP 74655. LOTS TO BE MERGED PER FUTURE PARCEL MAP (PROCESSING CONCURRENTLY)

10 0 20 40
SCALE IN FEET
1 inch = 20 ft.

BCW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

BCW ARCHITECTS | 2909 WASHINGTON BLVD - OGDEN, UT 84401 | PH: 801-618-3463 | www.BCW-SERVICES.com

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BVE
CIVIL•STRUCTURAL•SURVEY•PLANNING
9449 BALBOA AVE. STE 270
SAN DIEGO, CA 92123 619.299.5550

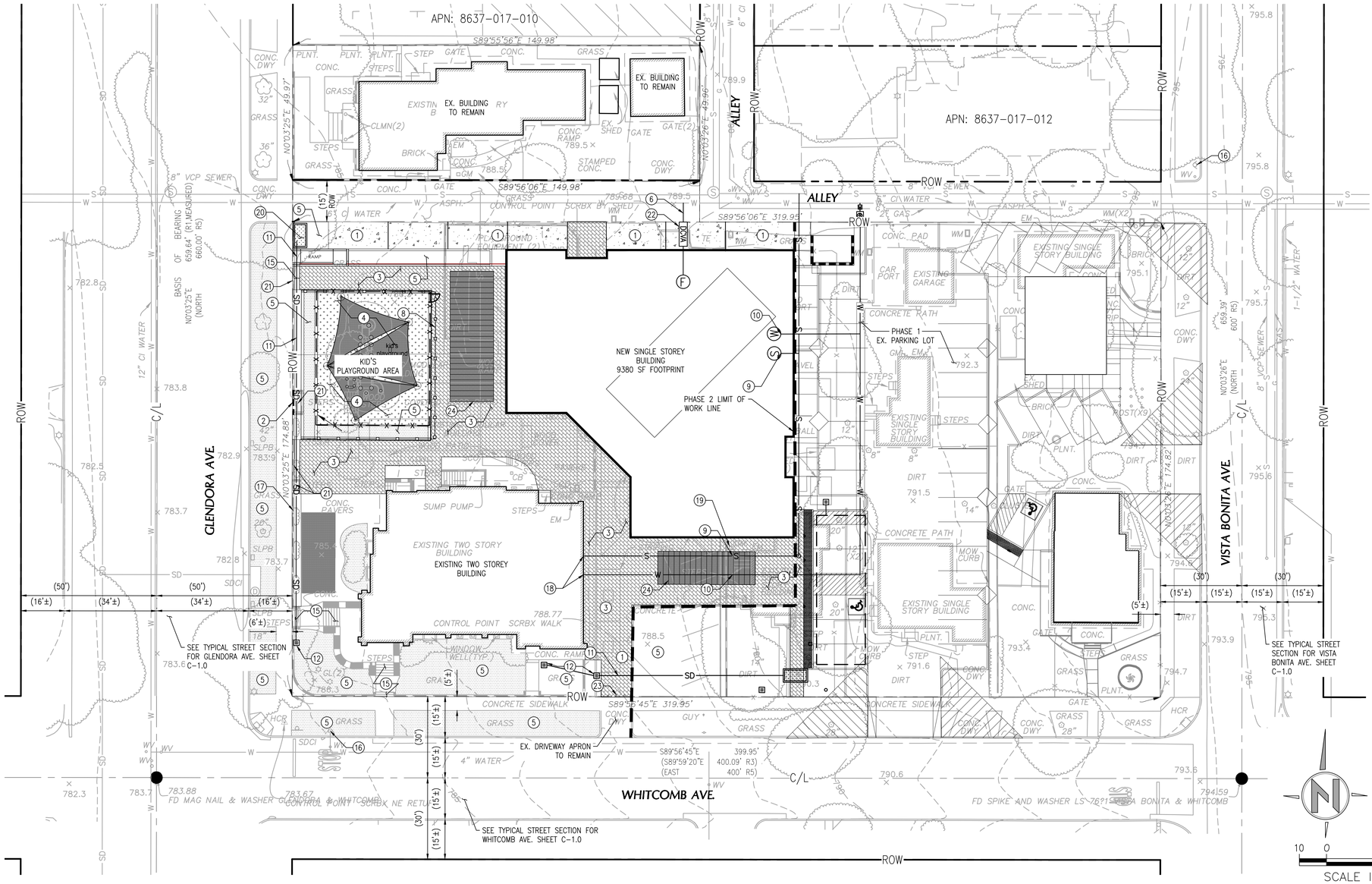
SEAL:
REGISTERED PROFESSIONAL ENGINEER ☆ MICHAEL A. SLAWSON ☆ No. C 058827 Exp. 12-31-20 CIVIL ☆ STATE OF CALIFORNIA

SHEET TITLE:
CIVIL SITE PLAN
PHASE 1

PROJECT: AC457 GLENDORA ORIGINAL ISSUE: CLK

SHEET NUMBER:
C-1.1

DO NOT SCALE DRAWING



LEGEND

- PROPERTY LINE/RIGHT-OF-WAY ..... P/L / ROW
- CENTER LINE ..... C/L
- LOT LINE .....
- PHASE 2 LIMIT OF WORK LINE.....
- CONCRETE PAVEMENT .....
- SITE TRIANGLE .....
- PERMEABLE PAVERS .....
- ENHANCED CONCRETE PAVEMENT .....
- LANDSCAPE AREA .....
- MODULAR WETLAND OR EQUAL .....
- PLAY AREA SURFACE .....
- NEW STORM LINE ..... SD
- NEW DOMESTIC WATER SERVICE ..... W
- NEW PRIVATE SEWER LATERAL ..... S
- NEW RETAINING WALL .....
- NEW CATCH BASIN .....
- DOMESTIC WATER POC ..... (W)
- SEWER POC ..... (S)
- FIRE SERVICE POC ..... (F)

CONSTRUCTION NOTES

1. NEW CONCRETE PAVEMENT
2. NEW RETAINING WALL
3. NEW ENHANCED CONCRETE PAVEMENT. PATTERN/FINISH PER LANDSCAPE PLANS
4. NEW PLAYGROUND AREA & SURFACING PER LANDSCAPE PLANS
5. NEW LANDSCAPED AREA
6. NEW FIRE SERVICE
7. REMOVABLE BOLLARDS TO BE ADDED PER LANDSCAPE PLANS
8. SITE FENCE PER LANDSCAPE PLANS
9. CONNECT NEW SEWER LINE TO EX. SEWER STUB
10. CONNECT NEW WATER LINE TO EX DOMESTIC WATER STUB
11. NEW STORM PIPE
12. NEW CATCH BASIN
15. NEW STAIRS W/ CRIB WALLS
16. EX. HYDRANT
17. EX. RETAINING WALL TO REMAIN
18. EX. WATER & SEWER CONNECTIONS TO REMAIN
19. EX. GAS METER TO BE RELOCATED
20. MODULAR WETLAND TREATMENT SYSTEM OR EQUAL
21. EX. STAIRS/RETAINING WALL TO BE REMOVED
22. NEW DOUBLE CHECK VALVE ASSEMBLY PER CITY OF GLENDORA DWG 2.22
23. REMOVABLE BOLLARDS
24. NEW TRELLIS PER LANDSCAPE PLANS

BGW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BGW ARCHITECTS | 2909 WASHINGTON BLVD - OGDEN, UT 84401 | PH: 801-618-3463 | www.BGW-SERVICES.com

SEAL:
PROFESSIONAL ENGINEER — MICHAEL A. SLAWSON — No. C 058127 — Exp. 12-31-20 — CIVIL — STATE OF CALIFORNIA

BVE
CIVIL•STRUCTURAL•SURVEY•PLANNING
9449 BALBOA AVE. STE 270
SAN DIEGO, CA 92123 619.299.5500

SHEET TITLE:
CIVIL SITE PLAN
PHASE 2

PROJECT#: AC457 GLENDORA ORIGINAL ISSUE: CLF

SHEET NUMBER:
C-1.1

DO NOT SCALE DRAWING