PRELIMINARY HYDROLOGY REPORT
FOR A 2-YEAR STORM EVENT

Kingdom Hall
of
Jehovah’s Witnesses

LOCATED AT 23061 & 23071 EL TORO RD, CITY OF
LAKE FOREST, COUNTY OF ORANGE, CALIFORNIA

MAY 7, 2018

PREPARED FOR:
JW CONGREGATION SUPPORT
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SITE DESCRIPTION AND PURPOSE OF REPORT

The property herein described is located on El Toro Rd, in the City of Orange, Orange County, California. The 2.30 acre site is currently vacant. The proposed project includes two single-story church buildings of 3,327 sf each; a parking lot area of 54,506 sf provides 140 parking spaces; landscaped areas totaling 45,747 sf including a Dry Extended Detention Basin (DEDB) at the south corner of property. The project is bordered on the southeast by El Toro Road, on the southwest by railroad right-of-way, on the northwest by single family homes, and on the northeast by an apartment complex.

The purpose of this preliminary drainage report is to determine the volume from the 2 year 24 hour storm to size the stormwater storage facilities.

DRAINAGE DESIGN

The existing site drains southwesterly towards the railroad right-of-way. Runon from El Toro Road and the existing Kingdom Hall enters the site along the southeasterly boundary and flows toward the railroad right-of-way as well.

The existing runon will be intercepted by a proposed V-ditch located along the southeasterly boundary to prevent comingling of the offsite and onsite stormwater. The V-ditch will convey the runon along the site boundary to a proposed rock apron sized to reduce the velocity before discharging into the railroad right-of-way and the historic drainage path.

The site drains toward a proposed Dry Extended Detention Basin (DEDB) at the south corner of the site. Landscape islands are incorporated throughout the site. Curb-cuts will be provided to allow sheet flow from paving to drain into and across the landscape islands. The roof drains will discharge to the ground and be routed to the DEDB by vegetative channels. The flow from the overall site will be conveyed to the DEDB. Please see the Conceptual Site Plan and Conceptual Grading Plan for additional detail.
The DEDB is sized for the LID/WQMP Design Capture Volume (DCV). The DCV is based upon these values: \( d = 0.85 \) in, \( A = 2.59 \) acres, \( \text{imp} = 0.61 \).

\[
C = (0.75 \times \text{imp}) + 0.15 = 0.61
\]

\[
\text{DCV} = C \times d \times A \times 43,560 \times \frac{1}{12} = 4,892 \text{ cf}
\]

The proposed Dry Extended Detention Basin (DEDB) with volume of 5,296 cf will provide adequate volume to store the Design Capture Volume (DCV) of 4,892 cf.

**HYDROLOGIC CONDITIONS OF CONCERN**

The existing site consists of soil type D that is graded with no vegetation (runoff curve number, \( CN=94 \)). The proposed site with 61% impervious (\( CN=98 \)) and 39% landscaped (\( CN=89 \)) produces an combined \( CN \) of 94, which is the same as the existing site. Therefore, prior to WQMP stormwater treatment, the volume and velocity of stormwater runoff for post-development conditions are nearly identical to those of the pre-development conditions.

The Water Quality Management Plan requires treatment of the stormwater prior to leaving the site. The treatment process inherently lengthens the runoff time of concentration. However, per the *Technical Guidance Document for the Preparation of Conceptual / Preliminary and/or Project Water Quality Management Plans (WQMPs)* Appendix I, Footnote 5:

> The North County Permit (Order R8-2009-0030), as adopted, provides the option of reducing \( T_c \) to less than the existing condition \( T_c \) (within 5 percent) as part of the primary and preferred option for mitigating HCOCs. However, a longer \( T_c \) is generally associated with natural conditions than urban conditions, and a longer \( T_c \) nearly universally results in lower concern for hydromodification impacts. In addition, it is not physically possible for a project to implement BMPs consistent with LID provisions of the permit without substantially increasing the \( T_c \) of the site. The use of retention BMPs results in water not discharged under design conditions, while the use of biotreatment BMPs general results in water not immediately discharged. Therefore, it would not generally be possible to mitigate HCOCs using the primary option for compliance described above while complying with LID requirements. This TGD therefore interprets this provision such that increases in \( T_c \) would be acceptable and reduction in \( T_c \) of more than 5 percent would not be acceptable. This interpretation is consistent with the overall goal of the permit to protect receiving waters from stormwater impacts to the MEP.

Thus, the proposed site will not adversely affect receiving waters susceptible to hydromodification.
CONCLUSION

The drainage report contained herein has been designed in accordance with applicable state and local ordinances. Therefore, if developed as planned, the drainage from this site will not adversely affect persons or property onsite or downstream.
Vicinity Map
Areas:

<table>
<thead>
<tr>
<th>Type</th>
<th>Impervious</th>
<th>Permeable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Dev</td>
<td>0.00</td>
<td>2.30</td>
<td>2.30 AC.</td>
</tr>
<tr>
<td>Post-Dev</td>
<td>1.40</td>
<td>0.90</td>
<td>2.30 AC.</td>
</tr>
<tr>
<td>Off-Site</td>
<td>1.96</td>
<td>0.85</td>
<td>2.83 AC.</td>
</tr>
</tbody>
</table>

Legend:

- Proposed Drainage Path
- Existing Drainage Path

Please see Conceptual Grading Plan for Onsite Improvements.
Lake Forest KH
Type I 24-hr 2-yr Rainfall=2.05"

Time span=0.00-24.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site
Runoff Area=2.300 ac  0.00% Impervious  Runoff Depth>1.44"
Flow Length=590’  Slope=0.0090 '/'  Tc=12.9 min  CN=94  Runoff=2.20 cfs  0.276 af

Total Runoff Area = 2.300 ac  Runoff Volume = 0.276 af  Average Runoff Depth = 1.44"
100.00% Pervious = 2.300 ac  0.00% Impervious = 0.000 ac
Summary for Subcatchment 1S: Existing Site

Runoff = 2.20 cfs @ 10.04 hrs, Volume= 0.276 af, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.10 hrs
Type I 24-hr 2-yr Rainfall=2.05"

<table>
<thead>
<tr>
<th>Area (ac)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.300</td>
<td>94</td>
<td>Newly graded area, HSG D</td>
</tr>
<tr>
<td>2.300</td>
<td>100</td>
<td>100.00% Pervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.9</td>
<td>590</td>
<td>0.0090</td>
<td>0.76</td>
<td></td>
<td>Lag/CN Method,</td>
</tr>
</tbody>
</table>

Subcatchment 1S: Existing Site

- Type I 24-hr 2-yr Rainfall=2.05"
- Runoff Area=2.300 ac
- Runoff Volume=0.276 af
- Runoff Depth>1.44"
- Flow Length=590'
- Slope=0.0090 '/'
- Tc=12.9 min
- CN=94
Routing Diagram for Lake Forest Dev
Prepared by HEITEC. Printed 5/6/2018
HydroCAD® 10.00-21 s/n 07525 © 2018 HydroCAD Software Solutions LLC

Proposed Site

1S

2P

DEDB
Time span=0.00-48.00 hrs, dt=0.10 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Proposed Site**
- Runoff Area=2.300 ac  60.87% Impervious  Runoff Depth=1.44"
- Flow Length=770’  Slope=0.0050 '/'  Tc=21.4 min  CN=94  Runoff=1.82 cfs  0.277 af

**Pond 2P: DEDB**
- Peak Elev=31.97'  Storage=0.098 af  Inflow=1.82 cfs  0.277 af
- Outflow=0.25 cfs  0.276 af

**Total Runoff Area = 2.300 ac  Runoff Volume = 0.277 af  Average Runoff Depth = 1.44"**
- 39.13% Pervious = 0.900 ac
- 60.87% Impervious = 1.400 ac
Summary for Subcatchment 1S: Proposed Site

Runoff = 1.82 cfs @ 10.14 hrs, Volume= 0.277 af, Depth= 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Type I 24-hr 2-yr Rainfall=2.05"

<table>
<thead>
<tr>
<th>Area (ac)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.400</td>
<td>98</td>
<td>Paved parking, HSG D</td>
</tr>
<tr>
<td>0.900</td>
<td>89</td>
<td>&lt;50% Grass cover, Poor, HSG D</td>
</tr>
<tr>
<td>2.300</td>
<td>94</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>0.900</td>
<td></td>
<td>39.13% Pervious Area</td>
</tr>
<tr>
<td>1.400</td>
<td></td>
<td>60.87% Impervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.4</td>
<td>770</td>
<td>0.0050</td>
<td>0.60</td>
<td></td>
<td>Lag/CN Method,</td>
</tr>
</tbody>
</table>

Subcatchment 1S: Proposed Site

Type I 24-hr 2-yr Rainfall=2.05"
Runoff Area=2.300 ac
Runoff Volume=0.277 af
Runoff Depth=1.44"
Flow Length=770'
Slope=0.0050 '/'
Tc=21.4 min
CN=94
Summary for Pond 2P: DEDB

Inflow Area = 2.300 ac, 60.87% Impervious, Inflow Depth = 1.44" for 2-yr event
Inflow = 1.82 cfs @ 10.14 hrs, Volume= 0.277 af
Outflow = 0.25 cfs @ 11.98 hrs, Volume= 0.276 af, Atten= 87%, Lag= 110.4 min
Primary = 0.25 cfs @ 11.98 hrs, Volume= 0.276 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.10 hrs
Peak Elev= 31.97' @ 11.98 hrs  Surf.Area= 0.069 ac  Storage= 0.098 af

Plug-Flow detention time= 217.4 min calculated for 0.276 af (100% of inflow)
Center-of-Mass det. time= 218.2 min ( 997.7 - 779.5 )

Volume Invert Avail.Storage Storage Description
#1 30.10' 0.122 af  16.00"W x 100.00'L x 2.20'H Prismatoid  Z=3.0

Device Routing Invert Outlet Devices
#1 Primary 32.00' 100.0' long x 4.0' breadth Broad-Crested Rectangular Weir
Head (feet)  0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

#2 Primary 30.10' 3.0" Round Culvert
L= 21.6' CMP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 30.10' / 29.10'  S= 0.0463 '/'  Cc= 0.900
n= 0.012, Flow Area= 0.05 sf

Primary OutFlow Max=0.25 cfs @ 11.98 hrs  HW=31.97' (Free Discharge)
1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)
2=Culvert (Inlet Controls 0.25 cfs @ 5.02 fps)
Pond 2P: DEDB

Inflow Area = 2.300 ac
Peak Elev = 31.97'
Storage = 0.098 af

Flow (cfs)

Time (hours)

1.82 cfs

0.25 cfs