

Following the model simulation run, GIS tools are used to post-process output text files to create shape files and rasters and hydrograph plots as described in Section 2.1.4 below.

#### 2.1.4 LIP Event Simulation Results

The FLO-2D model results, maximum flood depth, maximum water surface elevation and maximum velocity, are presented on Figure 2.1-5, Figure 2.1-6, Figure 2.1-7, and Figure 2.1-8.

Throughout this section and on all associated figures, the term “maximum flood depth” refers to the maximum flood depth above grade. Figure 2.1-6 is similar to Figure 2.1-5 since it shows maximum flood depths, but Figure 2.1-6 uses a classified graphic scale to display results to more easily see the range of depth. The intent of Figure 2.1-6 is to clearly identify the flood depth levels and areas on the site with more than 0.5 ft. of depth above grade.

##### 2.1.4.1 Critical Door Locations

HCGS is flood protected to elevations significantly above the predicted flood depths associated with the LIP event. However, in order to implement that flood protection, water tight doors must be closed. Since the flood depths predicted in this analysis exceed the door sill elevations at some locations, the time to exceed the threshold is considered the critical parameter for this analysis.

Each of the door locations is assigned a unique ID and corresponding FLO-2D grid cell from the model. There are nine locations at grade (IDs 1-9) for HCGS (see Figure 2.1-3 for locations) which represent the location of a watertight door. At each of the door locations, the maximum WSEL, depth, and velocity were determined. The duration of flooding (i.e., the amount of time when the water surface elevation exceeds the door elevation) was also computed at each door location.

The results are summarized in Table 2.1-3. In addition, depth-time hydrographs at each of the door locations were extracted from the model. These plots show the flood depths and durations for each door location, and are presented in Figures 2.1-10 through 2.1-18. Table 2.1-3 lists the corresponding figure number for each door location’s hydrograph.

##### 2.1.4.2 Erosion Potential

The maximum velocities in Table 2.1-3 at all critical door locations are relatively low, ranging from 0.61 to 0.91 ft. per second (fps). Figure 2.1-8 also shows that the maximum velocities resulting from the LIP event are less than 2.5 fps in the immediate vicinity of all safety-related structures. In general, the areas near the door locations and surrounding the safety-related structures are highly compacted and covered with pavement, concrete, or gravel. Thus, the potential for erosion/deposition during the LIP event is low, because flow velocities less than 2.5 fps are not expected to erode these materials, according to the maximum permissible velocities shown in Chow’s Open Channel Hydraulics (Reference 2.1-4).

#### 2.1.4.3 Final Floodplain Depths and Velocities

In order to evaluate the duration of flooding and associated “draindown” time, the model simulation was run for 12 hours (11 hours of simulated flood routing following the 1-hour precipitation event). The model results indicate that the flood elevations will recede below all of the door elevations after 8.1 hours from the start of the 1-hour precipitation event (see Table 2.1-3).

The final floodplain depths at the end of 12 hours are shown on Figure 2.1-9. As shown on the figure, there will be some locations of standing or ponded water that will drain slowly or eventually infiltrate/evaporate. The final velocities at 12 hours are essentially negligible (less than 0.2 fps for the entire site except at a few isolated locations).

#### 2.1.5 Conclusions

The model results indicate that door locations around the plant area will experience flood depths from 0.5 ft. to about 1.7 ft. above grade during a LIP event, resulting in a peak WSEL of 12.75 ft. NAVD or 102.6 ft. PSD. The flood depth exceeds the door sill elevations within minutes. Based on these results, the reevaluated LIP flood elevations are above the CLB and are further assessed in Chapter 3.

#### 2.1.6 References

- 2.1-1 U.S. Nuclear Regulatory Commission, “Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America,” NUREG/CR-7046, November 2011.
- 2.1-2 National Oceanic and Atmospheric Administration, “Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian,” Hydrometeorological Report (HMR) No. 52, August, 1982.
- 2.1-3 FLO-2D Software, Inc., “FLO-2D Reference Manual,” Version 2009, 2009.
- 2.1-4 Chow, V.T. “Open-Channel Hydraulics,” McGraw-Hill, New York, 1959.
- 2.1-5 MASER Consulting, PA ALTA/ACSM Land Title Survey for PSEG Nuclear LLC of Block 26, Lots 4, 4.01, 5 and 5.01, Job Number 05001694D, Index Number HASU023453 dated June 13, 2008.

**Table 2.1-1**  
**1-Hour, 1 Square Mile PMP Rainfall Depths**

<b>Duration</b>	<b>Area (mi<sup>2</sup>)</b>	<b>Multiplier</b>	<b>Applied to</b>	<b>Local Intense Precipitation (in)</b>	<b>Note</b>
60 min	1	NA	NA	18.10	HMR 52 Figure 24
30 min	1	0.753	1-hr, 1-mi <sup>2</sup> PMP	13.63	HMR 52 Figure 38
15 min	1	0.525	1-hr, 1-mi <sup>2</sup> PMP	9.50	HMR 52 Figure 37
5 min	1	0.334	1-hr, 1-mi <sup>2</sup> PMP	6.05	HMR 52 Figure 36
0	1	0.000	N/A	0.00	N/A

**Table 2.1-2**  
**FLO-2D Manning's n Values**

<b>Description</b>	<b>Manning's n</b>
Grass/Vegetation	0.05
Developed/Pavement	0.03
Debris/Obstructions	0.10



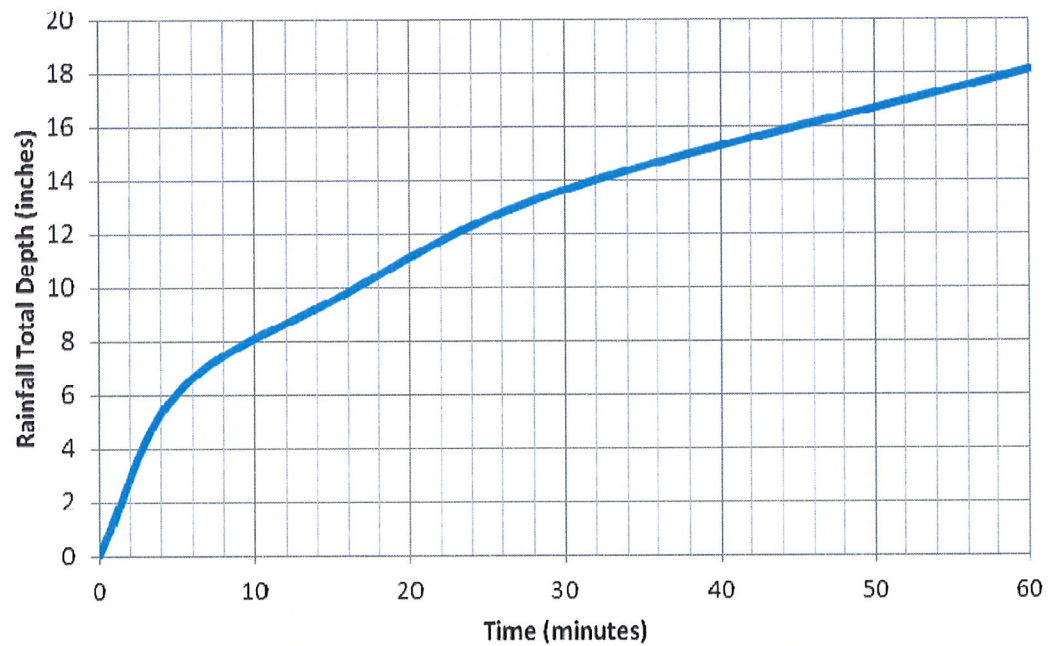
**Table 2.1-3  
 LIP Analysis Results Summary at Door Locations**

HCGS Door Number	Door Location ID <sup>(a)</sup>	FLO-2D Grid Cell	Max WSEL (ft. NAVD)	Max Flood Depth Above Grade Elevation (ft.)	Max Velocity (fps)	Time to Max Depth (hrs)	Door Elevation (ft) (NAVD)	Duration of Flooding above Door Elevation (hrs)	Depth-Time Plot Figure Number
6312 6323B	1	125277	12.69	0.78	0.67	0.99	12.20	2.60	2.1-10
3340B 3337B S-13 Hatch	2	124127	12.75	1.70	0.91	1.00	12.20	2.50	2.1-11
5315A 5315C	3	141567	12.46	0.49	0.79	0.17	12.20	1.90	2.1-12
3209A 3315B	4 <sup>(b)</sup>	139295	12.66	1.66	0.61	1.00	12.20	1.90	2.1-13
3329A 3331B	5 <sup>(b)</sup>	159035	12.23	1.23	0.91	1.00	12.20	0.05	2.1-14
3301A 3305B	6	157277	12.04	1.04	0.63	0.99	12.20	0.00	2.1-15
4304 4323A	7	158421	11.87	0.87	0.7	1.01	12.20	0.00	2.1-16
SWIS #1 SWIS #2	8	147881	9.67	0.67	0.74	0.08	12.20	0.00	2.1-17
SWIS #3 SWIS #4	9	150787	9.66	0.66	0.77	0.08	12.20	0.00	2.1-18

a) See Figure 2.1-3 for corresponding door location IDs.

b) Locations 4 and 5 represent turbine building doors that could allow water to flow towards the interior watertight doors between the turbine building and auxiliary building.

**Figure 2.1-1**  
**1-Hour, 1-Square-Mile PMP Rainfall Distribution Plot**



**Figure 2.1-2**  
**1-Hour, 1-Square-Mile PMP Rainfall Hyetograph**

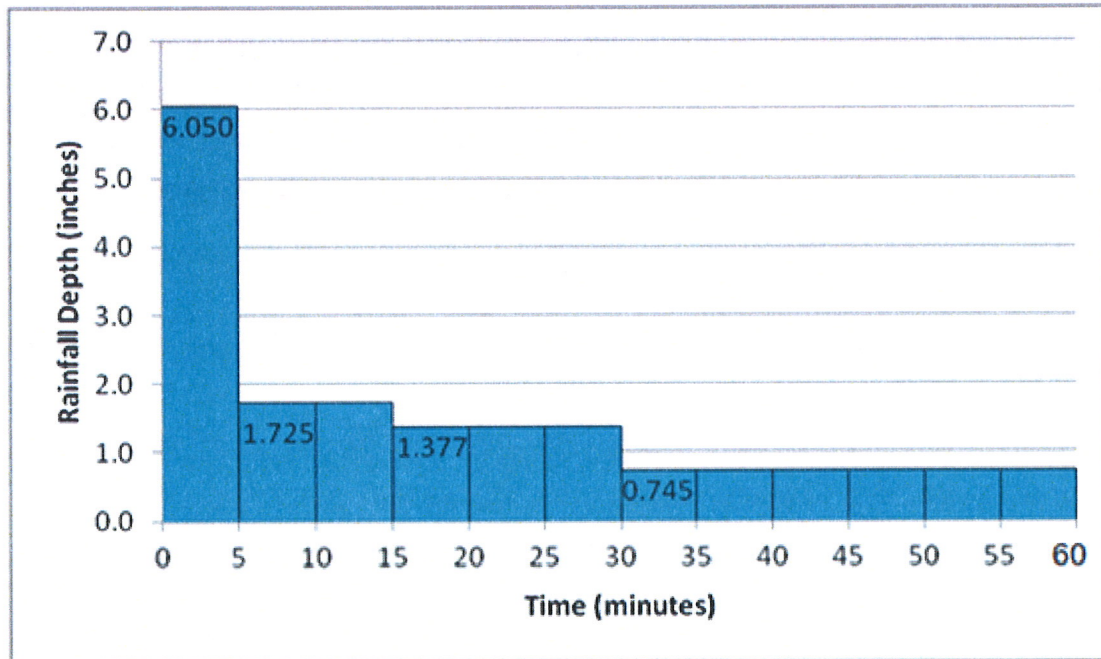




Figure 2.1-3  
General Site Layout and FLO-2D Model Components





Figure 2.1-4  
FLO-2D Manning's n Values

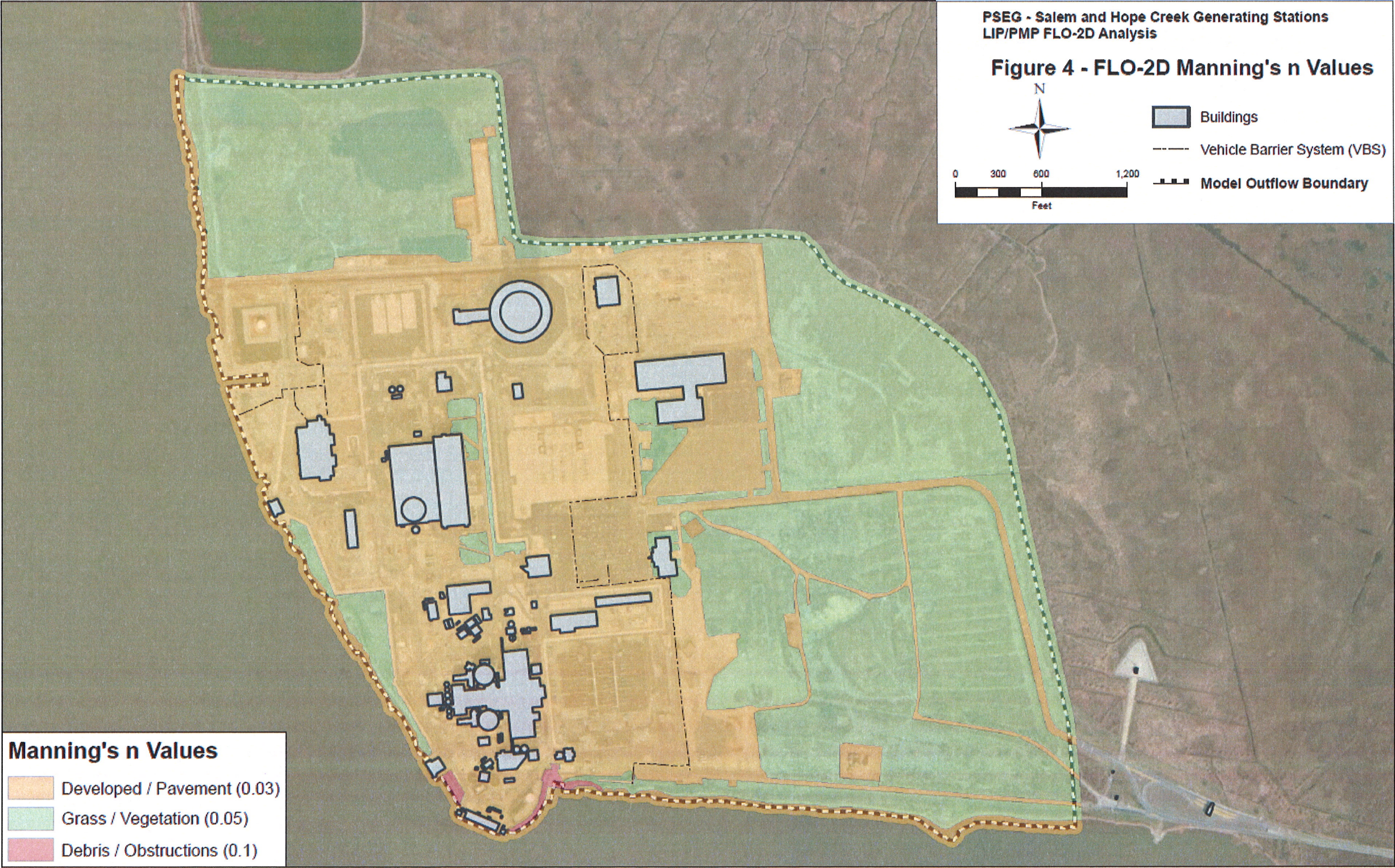




Figure 2.1-5  
Maximum Flood Depth (Above Grade)

