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Charles F. Arnone
Site Vice President

PNP 2018-036

September 25, 2018

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: Revised Mitigating Strategies Assessment for Flooding Pursuant to 10 CFR 50.54(f) Request for Information Regarding Recommendation 2.1: Flooding of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident

Palisades Nuclear Plant
Docket 50-255
Renewed Facility Operating License No. DPR-20

References:

1. NRC letter, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident*, dated March 12, 2012 (ADAMS Package Accession No. ML12056A046)
2. Entergy Nuclear Operations, Inc. letter, PNP 2015-018, *Required Response 2 for Near-Term Task Force Recommendation 2.1: Flooding – Hazard Re-Evaluation Report*, dated March 11, 2015 (ADAMS Accession No. ML15106A681)
3. NRC Order Number EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ADAMS Accession No. ML12054A736)
4. NRC memorandum, *Staff Requirements - COMSECY-14-0037 - Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards*, dated March 30, 2015 (ADAMS Accession No. ML15089A236)
5. NRC letter, *Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events*, dated September 1, 2015 (ADAMS Accession No. ML15174A257)

6. Nuclear Energy Institute (NEI) report NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 2, dated December 2015 (ADAMS Accession No. ML16005A625)
7. NRC Interim Staff Guidance JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events*, dated January 22, 2016 (ADAMS Accession No. ML15357A163)
8. NRC letter, *Palisades Nuclear Plant – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC No. MF6128)*, December 23, 2015 (ADAMS Accession No. ML15356A765)
9. Entergy Nuclear Operations, Inc. letter, PNP 2016-063, *Mitigating Strategies Assessment for Flooding Submittal*, dated December 19, 2016 (ADAMS Accession No. ML16354A054)

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a Title 10 of the Code of Federal Regulations (CFR), paragraph 50.54(f) letter to all power reactor licensees and holders of construction permits in active or deferred status (Reference 1). The letter contained in Enclosure 2 specific requested actions, requested information, and required responses associated with Recommendation 2.1: Flooding. One of the required actions was to submit the Hazard Reevaluation Report, which Entergy Nuclear Operations, Inc. (ENO) provided for Palisades Nuclear Plant (PNP) in Reference 2.

Concurrent with the Hazard Reevaluation Report, ENO developed and implemented mitigating strategies for PNP in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Reference 3). In Reference 4, the NRC affirmed that licensees need to address the reevaluated flood hazards within their mitigating strategies for beyond-design-basis external events, and this expectation was confirmed by the NRC in Reference 5. Guidance for performing a mitigating strategies assessment (MSA) for flooding is contained in Appendix G of Reference 6, which was endorsed by the NRC in Reference 7. In Reference 8, the NRC concluded that the "reevaluated flood hazards information is suitable for the assessment of mitigating strategies, developed in response to Order EA-12-049" for PNP.

In the PNP MSA for flooding provided in Reference 9, ENO elected to use a hybrid deterministic-probabilistic analytical method to determine the combined event probable maximum storm surge.

maximum storm surge.

Subsequent to the Reference 9 submittal, ENO revised the MSA for flooding to use the combined event probable maximum storm surge that was previously calculated in Reference 2 as an alternative to the combined event probable maximum storm surge determined using the hybrid deterministic-probabilistic method.

The revised MSA for flooding concludes that, for the postulated local intense precipitation flooding event, the existing FLEX strategies can be implemented as designed. For the postulated combined event probable maximum storm surge, the revised MSA concluded that installed, safety-related structures, systems, and components would remain capable of performing their safety functions; therefore, no changes to the FLEX strategy are required.

The revised MSA for flooding, which supersedes the MSA for flooding analysis provided in Reference 9, is provided in the attachment to this letter.

This letter contains no new or revised regulatory commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 25, 2018.

Sincerely,

CFA/jse

Attachment: Mitigating Strategies Assessment for Flooding Documentation Requirements at Palisades Nuclear Plant, Revision 1

cc: Director of Office of Nuclear Regulation, USNRC
Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

PNP 2018-036

Attachment

Mitigating Strategies Assessment for Flooding Documentation Requirements at Palisades Nuclear Plant

Revision 1

22 Pages Follow

Entergy

ENTERGY NUCLEAR
Engineering Report Cover Sheet

Engineering Report Title:

MITIGATING STRATEGIES ASSESSMENT FOR FLOODING DOCUMENTATION REQUIREMENTS AT PALISADES NUCLEAR PLANT

Engineering Report Type:

New ☐ Revision ☒ Cancelled ☐ Superseded ☐
Superseded by: ______

Applicable Site(s)

IP1 ☐	IP2 ☐	IP3 ☐	JAF ☐	PNPS ☐	VY ☐	WPO ☐
ANO1 ☐	ANO2 ☐	ECH ☐	GGNS ☐	RBS ☐	WF3 ☐	PLP ☒

EC No. 77287

Report Origin: ☐ Entergy ☒ Vendor
Vendor Document No.: ENTCORP037-REPT-002

Quality-Related: ☐ Yes ☒ No

Prepared by:	Prepared by Enercon Responsible Engineer (Print Name/Sign)	Date: 9/19/18
Design Verified:	N/A Design Verifier (if required) (Print Name/Sign)	Date: N/A
Reviewed by:	Greg Hubers [signature] Reviewer (Print Name/Sign)	Date: 9/24/18
Approved by:	Bob White [signature] Supervisor / Manager (Print Name/Sign)	Date: 9-24-18

ENERCON Excellence—Every project. Every day.	PROJECT REPORT COVER SHEET	PAGE 2 OF 22

Title:	MITIGATING STRATEGIES ASSESSMENT FOR FLOODING DOCUMENTATION REQUIREMENTS AT PALISADES NUCLEAR PLANT	REPORT NO.: ENTCORP037-REPT-002
		REVISION: 1
		Client: Entergy
		Project Identifier: ENTGPAL00134

Item	Cover Sheet Items	Yes	No
1	Does this Project Report contain any open assumptions, including preliminary information that require confirmation? (If **YES**, identify the assumptions.)	☐	☒
2	Does this Project Report supersede an existing Project Report? (If **YES**, identify the superseded Project Report.) **Superseded Project Report No.** ______________	☐	☒

Scope of Revision:

Revision 1 does not utilize the results developed from an Empirical Simulation Technique (EST) analysis performed to support Revision 0 of this report. Instead, this revision uses the results provided in the Palisades Flooding Hazard Re-Evaluation.

Revision Impact on Results:

Due to the use of the different flooding event results and the preference of the site to not deploy tiger dams to protect the FLEX Pump, Rev. 1 of this report utilizes a different method than Rev. 0 (i.e., Path 3 vs Path 2 from NEI 12-06). Therefore, the conclusions are also revised to reflect the new approach.

Safety-Related ☐		Non-Safety-Related ☒
Originator:	**Dora Garcia** Dora G Garcia	
Reviewer:	**Brian Froese** Brian Froese	
Approver:	**Jared Monroe** Jared Monroe	**Date: 09/19/2018**

MITIGATING STRATEGIES ASSESSMENT FOR FLOODING DOCUMENTATION REQUIREMENTS AT PALISADES NUCLEAR PLANT	REPORT NO.: ENTCORP037-REPT-002
	REVISION: 1

PROJECT REPORT REVISION STATUS

REVISION	DATE	DESCRIPTION
0	11/18/2016	Initial Issue
1	9/19/2018	Revision 1 does not utilize the results developed from an Empirical Simulation Technique (EST) analysis performed to support Revision 0 of this report. Instead, this revision uses the results provided in the Palisades Flooding Hazard Re-Evaluation.

ATTACHMENT REVISION STATUS

APPENDIX NO.	NO. OF PAGES	REVISION	ATTACHMENT NO.	NO. OF PAGES	REVISION
A	2	1			
B	2	1			
C	4	1			

Mitigating Strategies Assessment
Flooding Documentation Requirements
Palisades Nuclear Plant

Acronyms:

- AMS – Alternate Mitigating Strategy
- AWL – Antecedent Water Level
- CDB – Current Design Basis
- ELAP – Extended Loss of AC Power
- EST – Empirical Simulation Technique
- FHRR – Flood Hazard Re-evaluation Report
- FLEX DB – FLEX Design Basis (flood hazard)
- FIG – FLEX Implementation Guidelines
- FSB – FLEX Storage Building
- FSG – FLEX Support Guideline
- HHA – Hierarchal Hazard Assessment
- ISR – Interim Staff Response
- LIP – Local Intense Precipitation
- LUHS – Loss of Ultimate Heat Sink
- MSA – Mitigating Strategies Assessment
- MSFHI – Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- NGVD29 – National Geodetic Vertical Datum of 1929
- NRC – Nuclear Regulatory Commission
- NSRC - National SAFER Response Center
- PCS – Primary Containment System
- PLP – Palisades Nuclear Plant
- PMSS – Probable Maximum Storm Surge
- PMWS – Probable Maximum Wind Storm
- RCS – Reactor Coolant System
- SFP – Spent Fuel Pool
- UHS – Ultimate Heat Sink

Definitions:

FLEX Design Basis: the flood hazard for which FLEX was designed.

FLEX Design Basis Flood Hazard: the controlling flood parameters used to develop the FLEX flood strategies.

1. Summary

The MSFHI provided in the Palisades FHRR (Ref. 1) evaluates the eight flood-causing mechanisms and Combined Event PMSS flood, identified in Attachment 1 to Enclosure 2 of the NRC information request (Ref. 6). The ISR and Staff Assessment provided by the NRC (Refs. 2, 4 and 16) identified the flood mechanisms listed below as not bounded by the CDB:

- (1) LIP
- (2) Storm surge (H.4 Combined Event)

For Mechanism (1), the LIP, the FLEX strategies can be implemented as designed. For Mechanism (2), the period of inundation of approximately 10 hours impacts the FLEX strategy, as it was designed around a 30-minute seiche. Impacts of the Combined Events PMSS include flooding in the Intake Structure and parts of the deployment route adjacent to Lake Michigan. The flooding level in this area prevents the deployment and staging of the FLEX pump for the duration of the period of inundation (~10 hours). Therefore, an alternate mitigating strategy (AMS) assessment was performed to evaluate the impacts of Mechanism (2). The AMS determined that installed, safety-related SSCs would remain functional to perform safety functions. Therefore, no changes to the FLEX strategy are required.

Other re-evaluated flood hazard mechanisms (i.e.: tsunami, seiche, channel migrations/diversions, etc.), are bounded by the CDB and have no impact on the FLEX strategies. Additionally, Phase 3 activities were evaluated. These activities are also not impacted by the re-evaluated flood levels since they will have sufficiently receded by the time the Phase 3 strategy is implemented. Details of the FLEX strategies along with the bounding flood will be discussed later in this document.

2. Documentation

2.1. NEI 12-06, Rev. 4, Section G.2 – Characterization of the MSFHI

Characterization of the MSFHI is primarily summarized in Table 2 of the NRC's Interim Staff Response (Ref. 2) to the flood hazard re-evaluation submittal (Ref. 1). A more detailed description of the flood mechanisms identified in the MSFHI, along with the basis for inputs, assumptions, methodologies, and models, is provided in the following references:

- LIP: Reference 1, Section 3.1.
- Flooding in Streams and Rivers: Reference 1, Section 3.2.
- Dam Breaches and Failures: Reference 1, Section 3.3.
- Probable Maximum Storm Surge: Reference 1, Section 3.4.
- Seiche: Reference 1, Section 3.5.
- Tsunami: Reference 1, Section 3.6.
- Ice-Induced Flooding: Reference 1, Section 3.7.
- Channel Migration or Diversion: Reference 1, Section 3.8.
- Combined Event PMSS: Reference 1, Section 3.9.

Based on the results of the flood hazard re-evaluation, the ISR and Staff Assessment issued by the NRC (Refs. 2, 4, and 16) identified that the flood mechanisms described below are not bounded by the Palisades CDB. Therefore, these mechanisms are included in this MSA developed in response to Order EA-12-049. All other mechanisms evaluated in the MSFHI (i.e.: tsunami, seiche, channel migrations/diversions, etc.) are bounded by the design basis flood level and have no impact on the site. Note that all elevations presented here and throughout the MSA are reported in NGVD29.

Local Intense Precipitation

The LIP is included in the CDB but does not bound the MSFHI. LIP flooding depths range from 592.5 ft to 594.4 ft at the critical locations identified on the lower level. The LIP flood elevations on the upper level of the site range from 626.0 ft to 626.1 ft at the critical locations identified. This results in maximum flood depths that range from 1.8 ft to approximately 5.3 ft above grade.

Combined Event PMSS

The Combined Event PMSS is based on a stillwater elevation of 593.9 ft. The standing wave crest elevation on top of the combined stillwater elevation ranges up to an elevation of 602.2 ft. The lake-facing wall and north side of the screen house are shielded from wave action, thus resulting in a maximum combined events water surface elevation at these locations of 593.9 ft. The south door of the Intake Structure is exposed to minor waves moving parallel or away from the structure and result in a maximum water surface elevation of 594.2 ft.

2.2. NEI 12-06, Rev. 4, Section G.3 – Comparison of the MSFHI and FLEX DB Flood

A complete comparison of the CDB, the FLEX DB and re-evaluated flood hazards is provided in the tables listed below:

- Table 1 reflects data from the MSFHI for the LIP.
- Table 2 reflects data from the MSFHI for the Combined Event PMSS.

Table 1 - Flood Causing Mechanism (LIP) or Bounding Set of Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI LIP	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft NGVD29)	See Note 1	594.1	See Note 2	NB
	2. Max Wave Run-up Elevation (ft NGVD29)	N/I	594.1	See Note 3	B
	3. Max Hydrodynamic/Debris Loading (psf)	N/I	N/A	See Note 4	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	See Note 4	B
	5. Concurrent Site Conditions	N/I	N/A	See Note 5	B
	6. Effects on Groundwater	N/I	N/A	N/I	B
Flood Event Duration	7. Warning Time (hours)	N/I	N/I	N/I	B
	8. Period of Site Preparation (hours)	N/I	N/I	N/I	B
	9. Period of Inundation (hours)	N/I	N/I	See Note 6	NB
	10. Period of Recession (hours)	N/I	N/I	See Note 6	NB
Other	11. Plant Mode of Operations	Modes 1-6	Modes 1-6	Modes 1-6	B
	12. Other Factors	N/A	N/A	N/A	N/A

N/A = Not Applicable N/I = Not Included

Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination.

1. East side of Service Building is 601.0 ft. Ponding depth of 0.5 ft in other areas.
2. East side of Service Building is 605.8 ft, upper level is 626.1 ft and lower level is 594.4 ft.
3. Consideration of windwave- action for the LIP event is not explicitly required by NUREG/CR-7046 (Ref. 14) and is judged to be negligible because of flow depths.
4. The FHRR (Ref. 1) did not identify any hydrodynamic loading, debris loading, sediment deposition or erosion. These were not considered credible effects due to the relatively low flow velocities in general for a LIP event and limited debris sources within the protected area. There were a few areas with higher velocities, however these will be short in duration and significant erosion is not anticipated (Ref. 1, Section 3.1.2.1.5).
5. No antecedent storm was considered with the LIP event.
6. Flood heights around the FLEX Staging Area recede to <1.5 ft after 2 hours into the event (Ref. 1). The deployment routes from FSB A or FSB B to the staging area do not begin to fully recede until after 6 hours as shown in Appendix C of this report. Since no inundation or recession was included in the FLEX DB and the stillwater elevation is not bounded, these parameters are also considered not bounded.

Table 2- Flood Causing Mechanism (Combined Event PMSS) or Bounding Set of Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI Storm Surge	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft NGVD29)	594.1	594.1	593.9	B
	2. Max Wave Run-up Elevation (ft NGVD29)	See Note 1	594.1	See Note 2	NB
	3. Max Hydrodynamic/Debris Loading (psf)	See Note 3	N/A	See Note 3	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	See Note 4	B
	5. Concurrent Site Conditions	N/I	N/A	See Note 5	NB
	6. Effects on Groundwater	N/I	N/A	See Note 6	B
Flood Event Duration	7. Warning Time (hours)	N/I	N/I	N/I	B
	8. Period of Site Preparation (hours)	N/I	N/I	N/I	B
	9. Period of Inundation (hours)	0.5	0.5	See Note 7	NB
	10. Period of Recession (hours)	0.5	0.5	See Note 7	NB
Other	11. Plant Mode of Operations	Modes 1-6	Modes 1-6	Modes 1-6	B
	12. Other Factors	N/A	N/A	N/A See Note 8	N/A

	N/A = Not Applicable N/I = Not Included Additional notes, 'N/A' justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination. 1. Maximum wave run-up is not independently evaluated in the current design basis. The intake structure has been evaluated for approximately 8 ft of run-up. 2. The Combined Event calculation (Ref. 3) lists a maximum elevation resulting from wave action as 594.2 ft at the Intake Structure, 602.2 ft at the Discharge Structure, and 598.7 ft at the Feedwater Purity Building. Since the relevant outdoor FLEX activities that could be impacted by wave run-up will be at the Intake and Discharge Structures, the maximum of 602.2 ft is not bounded by the FLEX DB. 3. The capacity of the Intake Structure to withstand dynamic water loading up to elevation 597.0 ft bounds the calculated maximum Combined Event PMSS water surface elevation of 594.2 ft (standing wave crest elevation) at the Intake Structure. Hydrodynamic, hydrostatic and wave loads impacting the circulation water pipes were evaluated and the pipes were determined to be structurally adequate for the applied loads (Ref. 17). Although water flows beneath the circulation water pipes, nearshore waves that propagate from offshore break on the circulation water pipes and do not propagate further to the Screen House/Intake Structure. The other structures affected by debris loads (Feedwater Purity Building and Service Building) are not used for FLEX. 4. The coastline near PLP is not within a high risk erosion area as defined by the Michigan Department of Environmental Quality. 5. Wind wave effects are added on top of an AWL of 583.4 ft, which is the calculated 100-year lake elevation, and a probable maximum surge height of 9.7 ft, resulting in a Combined Event PMSS stillwater elevation of 593.1 ft (Ref. 1). Since the maximum wave run-up elevation is not bounded, this is also not bounded. 6. Because of the relatively short duration of flooding and slow percolation rate of the underlying soil, short term water level changes (i.e., storm surge) is unlikely to affect groundwater levels in the vicinity of Palisades and therefore is bounded (Ref. 3). 7. Using the more conservative Combined Event flood from the FHRR (Ref. 1), the flood is at its peak 2 ft of elevation for ~10 hours total. 8. The wind effects resultant from the PMWS extra-tropical storm identified in the FHRR (Ref. 1, Section 3.4) are not applicable.

2.3. NEI 12-06, Rev. 4, Section G.4 – Evaluation of Mitigating Strategies for the MSFHI

2.3.1. NEI 12-06, Rev. 4, Section G.4.1 – Assessment of Current FLEX Strategies

2.3.1.1. LIP – Current FLEX strategies are viable

Three flooding scenario parameters for the LIP are not bounded by the FLEX strategy: Max Stillwater Elevation, Period of Inundation, and Period of Recession. See Appendix A for the location of deployment paths and Appendix B for critical locations 19 and 20 described below.

The equipment stored in FSB A, which is located on the north side of the plant (Ref. 10), is protected to a minimum elevation of 594 ft 1 in. (Ref. 9). The LIP maximum flooding depths (Ref. 8, Appendix F-4) in this area remain below this elevation and therefore storage of the equipment will not be impacted. However, the maximum flooding levels along the deployment routes from FSB A to the staging areas identified in FSG-5 (Ref. 7) exceed 3 ft for large sections. Hydrographs along the deployment route from FSB A were not included in the LIP calculation (Ref. 8), however, using the hydrographs created for other areas of the plant as a basis suggest flood levels will recede to <2 ft by two hours into the event, remain stable until six hours, then decrease to <1 ft by eight hours. Therefore, deployment of equipment from this FSB can potentially be impacted during this period of inundation. The accessibility of FSB A will be evaluated during the Initial Assessment in FSG-5 (Ref. 7), which includes assessment of external plant flooding.

The equipment stored in FSB B, located near the abandoned security gate east of the employee parking lot (Ref. 10), is at elevation 647.5 ft (Ref. 9). This is significantly above the maximum flooding elevations identified in the ISR (Ref. 2) and therefore storage of the equipment is not impacted. The LIP maximum flooding depths between this FSB and the security entrance (Ref. 8, Appendix F-4) are generally low (<1 ft maximum).

The deployment route from FSB B along the south side of the plant (Ref. 7) is the least flooded path. The depths along this route are also generally low (<1 ft maximum), with the exception of the stretch (~400 ft) along the southwestern, shore-side of the plant where they can reach a maximum of ~4 ft. At these maximum flood heights, deployment and staging of the FLEX pump at the southwest or northwest corners of the Intake Structure (Ref. 10) could potentially be impacted. However, these maximum flood heights occur at the beginning of the LIP event and deployment of the FLEX equipment starts at 2 hours (Ref. 10, Table 1). Per Appendix C, hydrographs at three locations along this deployment stretch were created from the FLO-2D LIP model. From these hydrographs, after 2 hours the flood elevations are reduced to <2.1 ft. These flood elevations level off until approximately 6 hours, then decrease such that at 8 hours the flood elevation is <1 ft. The FLEX pump, which is the only piece of equipment deployed through this deployment path early into the event (i.e. before 8 hours), has a ground clearance of 26" or 2.2 ft (Ref. 15). This is higher than the maximum flood height of 2.1 ft at 2 hours into the event. For the FLEX truck, the dealership was consulted and it is capable of towing through this flood height. As an alternative, the front-end loader is also equipped with a tow hitch (Ref. 5) and could be utilized to tow equipment if needed. Therefore, deployment is not impacted by the LIP flood. Similarly, critical locations 19 and 20 outside the Intake Structure doors, where the FLEX pump is staged, recede to <1.5 ft flooding after 2 hours. Thus, staging can be accomplished as intended without impacting the sequence of events timeline (Ref. 10).

With the exception of the doors in the Intake Structure and Turbine Building, the primary FLEX strategy does not open any exterior doors that are at ground elevation. Section 5.1.1 of the FHRR (Ref. 1) discusses flooding through doorways and concludes flooding from the LIP is not a concern. For the Turbine Building and Intake Structure, all FLEX equipment is above the maximum flood height of 594.4 ft and therefore is not impacted. Note that AOP-38 (Ref. 12) already includes actions to place sandbags outside the Turbine Building South roll-up door. This, in combination with the short duration and recession of a LIP event provides reasonable assurance that operators will be able to able to accomplish actions in the Turbine Building early (<1 hr) into the event.

Other time sensitive activities listed in the FIP sequence of events timeline (Ref. 10, Table 1) were reviewed. All activities, including debris removal and deployment of equipment as described in the paragraph above, can be implemented as intended.

Revision 1 of PLP-RPT-15-00010 (Ref. 13) provided minor markups to the FHRR and explicitly identified two locations of flooding ingress that could potentially impact key systems, structures, and components (SSCs). These are through (1) Manhole #4 which eventually leads to the 1C Switchgear Room via conduits and (2) through Door #107 which eventually leads to MCCs used as part of the Phase 2 FLEX strategy. For Manhole #4, calculation EA-EC55593-01 (Ref. 19), which is referenced in the FHRR, determined that adequate space is available in the manholes to hold the potential leakage such that there is no concern to the 1C Switchgear Room. Therefore, no physical changes to this manhole or the conduits within are anticipated to be performed. For Door #107 ingress, a flood protection feature (such as a kickplate) will be permanently installed to prevent leakage through the door as part of a future action, which is discussed further in the Focused Evaluation (FE) (Ref. 18). As an interim compensatory measure, sandbags are stored outside of Door #107 and will be deployed to protect the door in the event of heavy rainfall. This is integrated into site procedure AOP-38 (Reference 12).

Access to the 1C Switchgear Room for deployment of the Phase 2 generator is part of the alternate strategy (Ref. 10) and therefore is not required since the primary generator location is available. However, access to this room is required for establishing SFP makeup, which is needed by 11 hours. This will not be impacted given the LIP recession times of 2-8 hours.

Therefore, the FLEX strategies are not affected by the reevaluated LIP results and can be implemented as designed.

2.3.1.2. Combined Event PMSS – Current FLEX strategies are not viable.

Three flooding scenario parameters for the storm surge are not bounded by the FLEX strategy: maximum wave run-up elevation, period of inundation, and period of recession. The storm surge maximum stillwater elevation of 593.9 ft and reflected wave height at the Discharge Structure of 602.2 ft are not bounded by the FLEX DB elevation of 594.1 ft. Furthermore, the FLEX DB recession time of 30 minutes does not bound this event. The maximum Combined Event PMSS is at its peak depth of 2 ft for ~10 hours, after which it recedes below 591.9 ft, which is <2 ft above the lower level elevation of 590 ft. This height of <2 ft is considered acceptable as indicated in Section 2.3.1.1. The 10-hour inundation period impacts the deployment and staging of the Phase 2 FLEX pump located on the southwest or northwest corners of the Intake Structure (Ref. 10). The area along the north and south sides of the Intake Structure where hoses from the FLEX pump will be run will also be impacted. These locations need to be accessed by operators as well to connect the FLEX pump used to establish steam generator (SG) makeup (Ref. 10, Section 2.17) by 8 hours after the initiation of an ELAP. Therefore, the FLEX strategies cannot be implemented during the period of inundation (~ 10 hours). Current Phase 2 FLEX strategies for RCS cooling are defeated during the event due to the inability to deploy the FLEX pump to the Lake Michigan access area (Intake Structure).

The existing FLEX strategies cannot be implemented as designed for the Combined Event PMSS mechanism. FLEX alone cannot be modified because alternate equipment is required during the period of inundation. Alternate Mitigating Strategies (AMS) are required.

2.3.1.3. Phase 3 – Current FLEX strategies are viable.

For Phase 3, the NSRC's ability to transport equipment to Staging Area B (site location where equipment will be pre-staged, parked, or placed prior to movement into the final location) is covered in the Palisades SAFER Response Plan (Ref. 11), which includes multiple means and pathways of transporting NSRC equipment to the site. Therefore, since Phase 3 begins no sooner than 72 hours into the event (Ref. 10, Section 2.3.3), transportation of NSRC equipment to the site is bounded given the recession times discussed in Sections 2.3.1.1 and 2.3.1.2. The primary and secondary Staging Area B are located east of the site nearby FSB B and use the same deployment pathway to get to the site. As such, the Phase 3 strategy can be implemented as intended and is not impacted by the flooding mechanisms evaluated in this MSA.

2.3.2. NEI 12-06, Rev. 4, Section G.4.2 – Assessment for Modified FLEX Strategies

For the Combined Event PMSS mechanism that FLEX is not viable, the period of inundation of approximately 10 hours makes modifying the existing FLEX strategies not practical without extensive modifications to flood protection features.

2.3.3. NEI 12-06, Rev. 4, Section G.4.3 – Assessment of Alternate Mitigating Strategies

The Alternate Mitigating Strategy guidance in NEI 12-06, Rev. 4, states that an AMS would not assume an ELAP and LUHS unless the flood event caused such consequences. The analysis presented in the Palisades Focused Evaluation (Ref. 18), concludes that an ELAP is not anticipated given the flood protection elevation of 594.4 ft, and that installed safety-related plant equipment would remain functional. Strategies for maintaining core cooling, PCS integrity, and SFP cooling can be performed through the use of existing plant procedures and equipment. Given that this flooding event does not affect the installed safety-related equipment (including the emergency diesel generators), Palisades will be able to cope and does not expect to have to modify the FLEX strategy to address the Combined Event PMSS flood mechanism.

2.4. References

1. PNP 2015-018, Required Response 2 for Near-Term Task Force Recommendation 2.1: Flooding - Hazard Re-Evaluation Report, March 11, 2015 (ML15106A681)
2. Palisades Nuclear Plant – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response To 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC No. MF6128), December 23, 2015
3. EA-EC54930-03, 32-9226981-000, Rev. 0, Palisades Nuclear Plant Flooding Hazard Re-Evaluation – Combined Events
4. Palisades Nuclear Plant – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood Causing Mechanism Reevaluation, February 14, 2018 (ML18037A625)
5. EC 46465, Rev. 0, (FLEX EC#2) - Basis (Base EC)
6. Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(F) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident, U.S. Nuclear Regulatory Commission, March 2012.
7. FSG-5, Rev. 0, Initial Assessment and FLEX Equipment Staging
8. EA-EC54930-05 Rev. 0, 32-9226944-002 – Palisades Nuclear Plant Flooding Hazard Re-Evaluation – Local Intense Precipitation
9. EC 46467, Rev. 0, (FLEX EC#11) – Storage Buildings
10. PLP-RPT-15-00049, Palisades Final Integrated Plan for FLEX Implementation, Rev. 0, (ML15351A360)
11. 38-9237574-000, Rev. 1, SAFER Response Plan for Palisades Nuclear Plant
12. AOP-38, Rev. 14, Acts of Nature
13. PLP-RPT-15-00010, Rev. 1, 51-9226987-000 - Palisades Nuclear Plant Flooding Hazard Re-Evaluation Report

14. NUREG/CR-7046, PNNL-20091, Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America
15. VTM M767 SH 2, Hale Fire Pump Co Operation and Service Maintenance Manual for PSM Single Stage Pump
16. Palisades Nuclear Plant – Correction Letter for Staff Assessments Associated with Response to 10 CFR 50.54(f) Information Request – Flood Causing Mechanism Reevaluation, May 3, 2018 (ML18086A218)
17. EA-EC54930-04, 32-9234660-000, Palisades Nuclear Plant Flooding Hazard Re-Evaluation – Wave Loadings on Cooling Tower Piping
18. ENTP051-REPT-001, Rev. 0, Focused Evaluation for External Flooding at Palisades Nuclear Plant
19. EA-EC55593-01, Rev. 000, Beyond Design Basis (BDB) Evaluation: Local Intense Precipitation Flow Through Manhole 4 to Manhole 1.

Appendix A: FLEX Equipment Deployment Paths

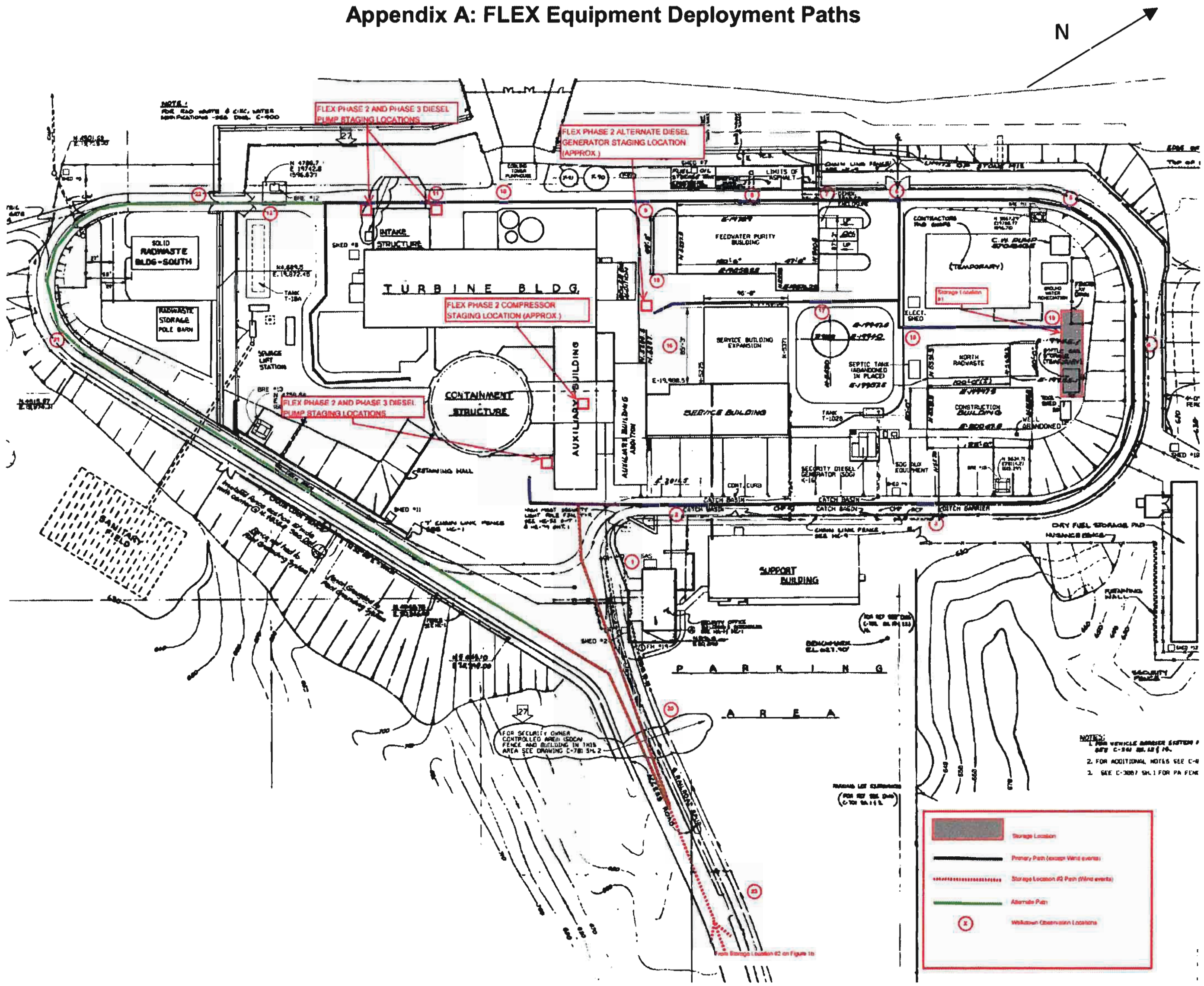

Figure A-1: Deployment Route Part 1 (Ref. 10)

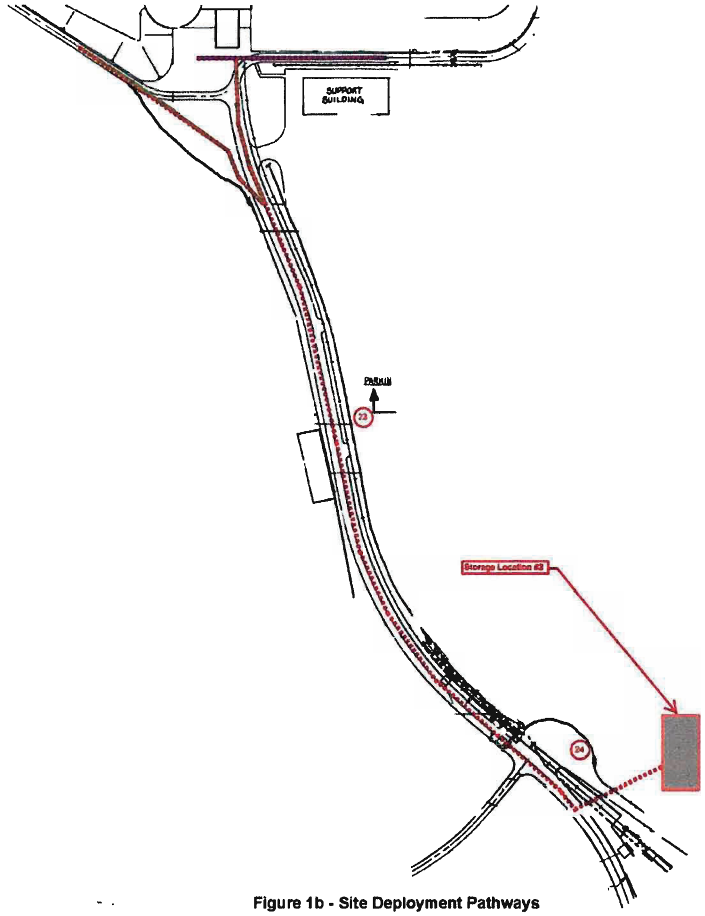

Figure 1b - Site Deployment Pathways

Figure A-2: Deployment Route Part 2 (Ref. 10)

Appendix B: FLEX Pump Staging Locations

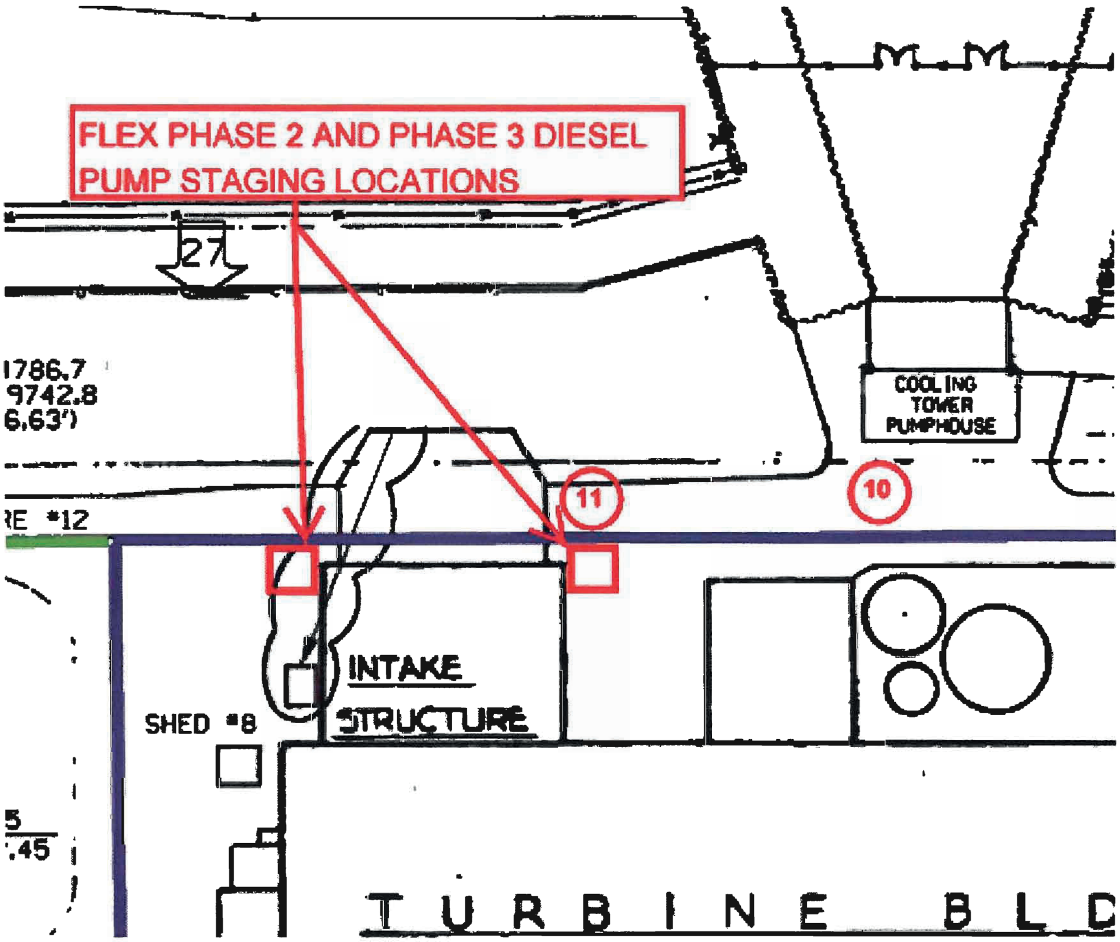

Figure B-1: FLEX Pump Staging Locations (Ref. 10)

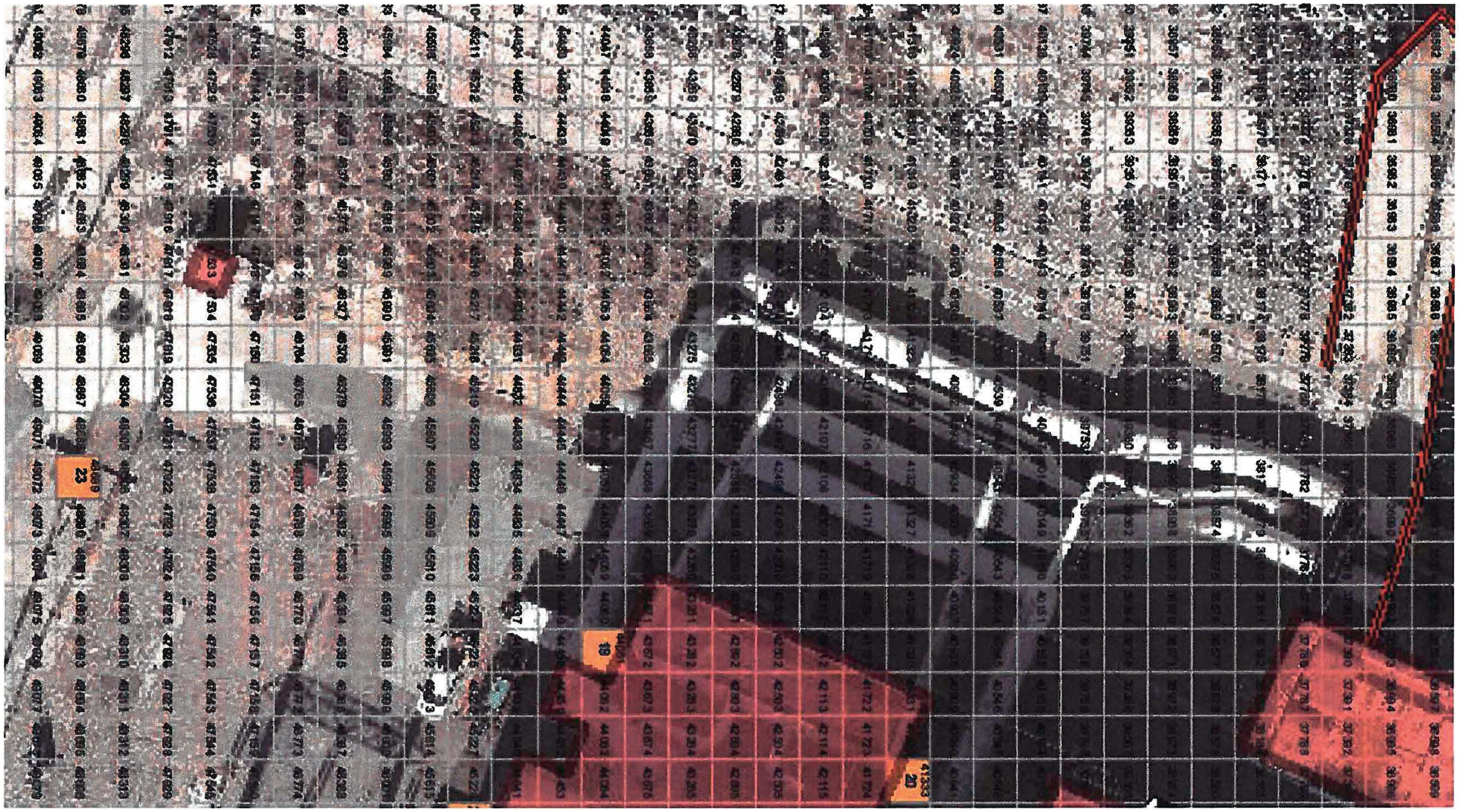

Figure B-2: Location of Critical Points 19 & 20 (Ref. 8, Appendix F-2)

Appendix C: Additional LIP Hydrographs

To evaluate the southwestern section of the FLEX deployment path where maximum flood heights are >4 ft, several locations along this route are selected. These are identified in the figure below, taken from Page F.1 of the LIP calculation (Ref. 8). Hydrographs at these three selected grid elements (46379, 49833, and 54757) are created from the FLO-2D model.

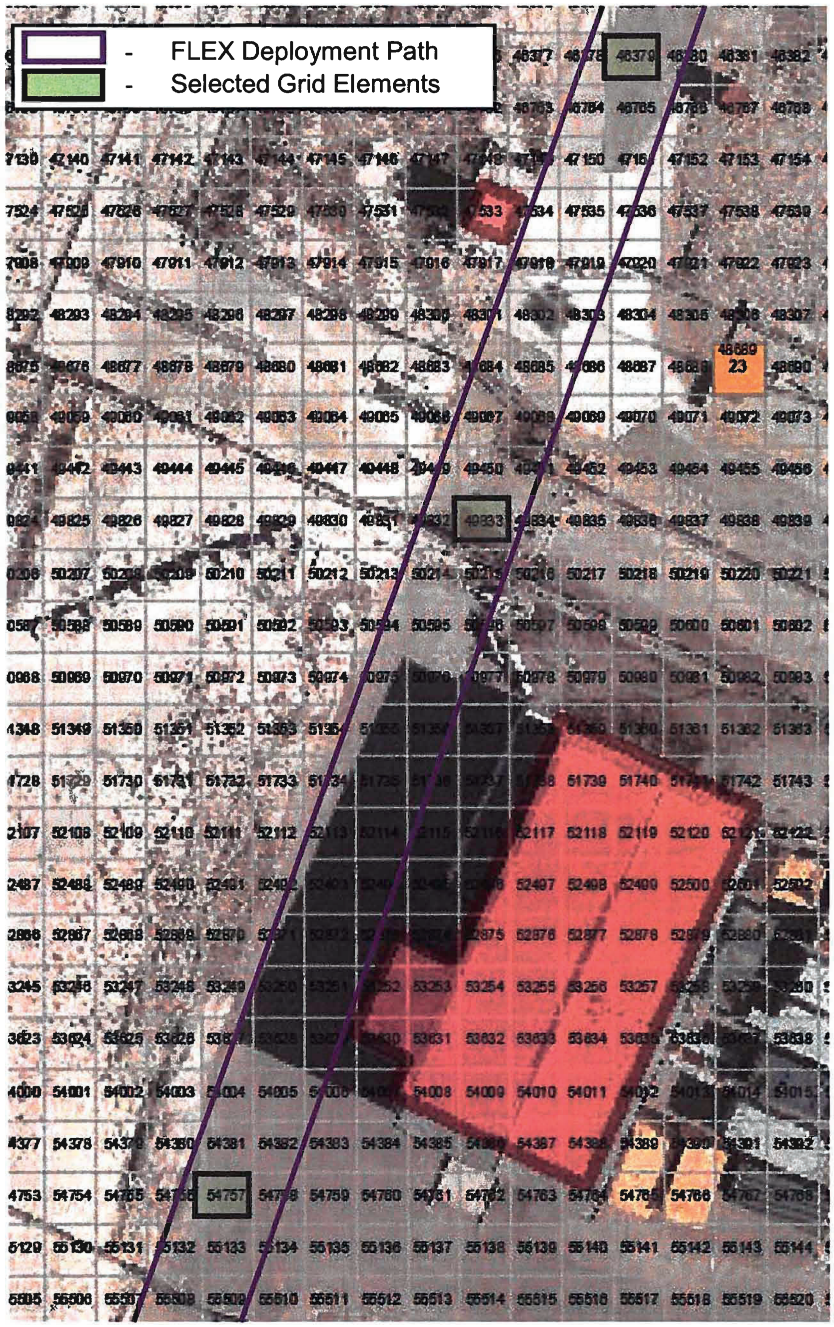

Figure C-1: Selected Grid Elements

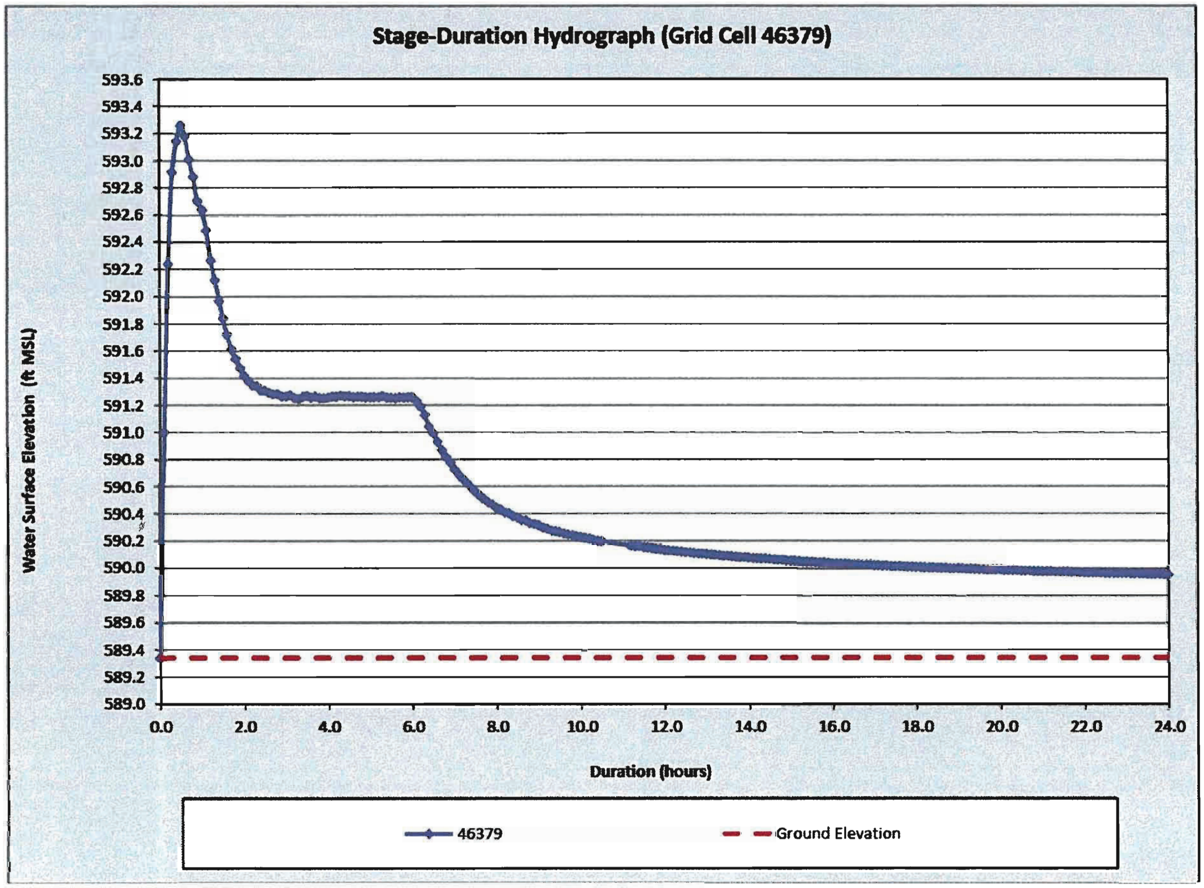

Figure C-2: Grid Element 46379 Hydrograph

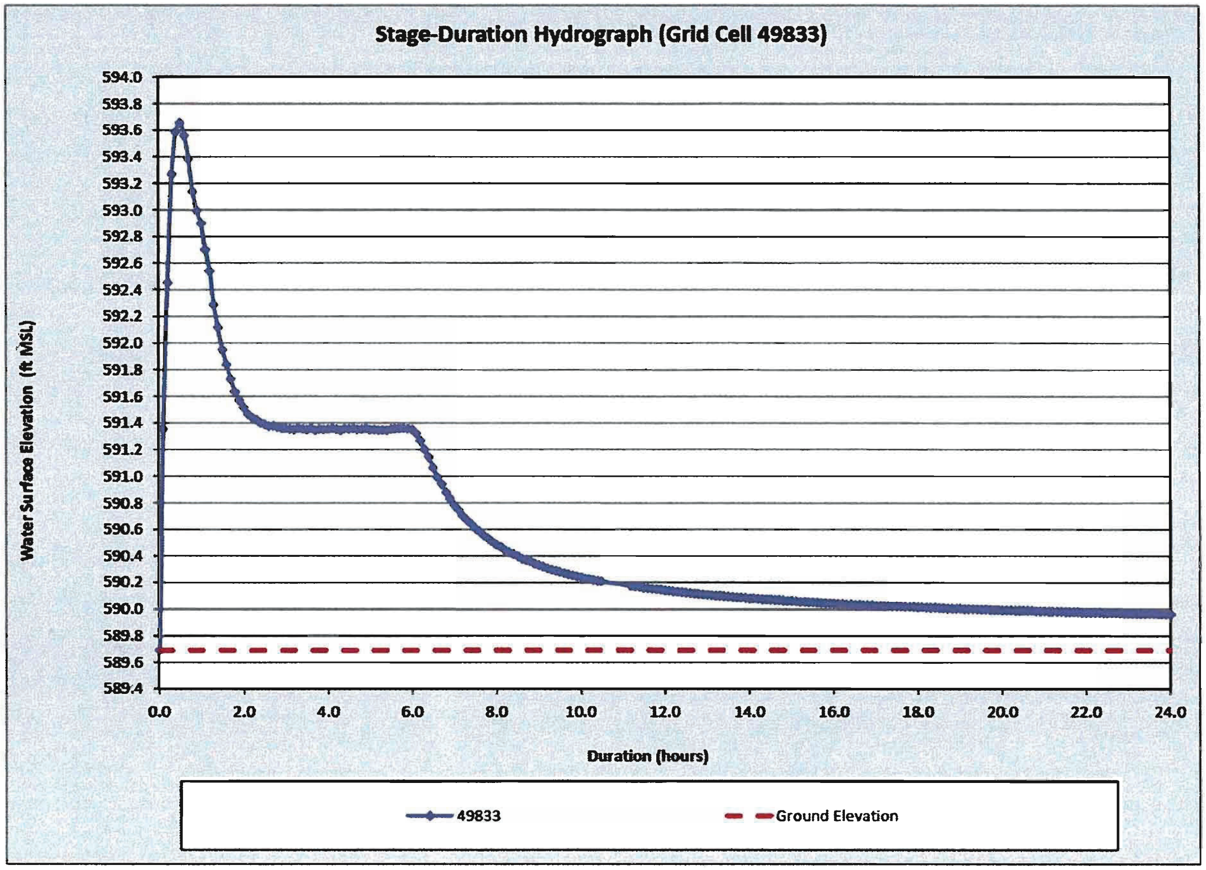

Figure C-3: Grid Element 49833 Hydrograph

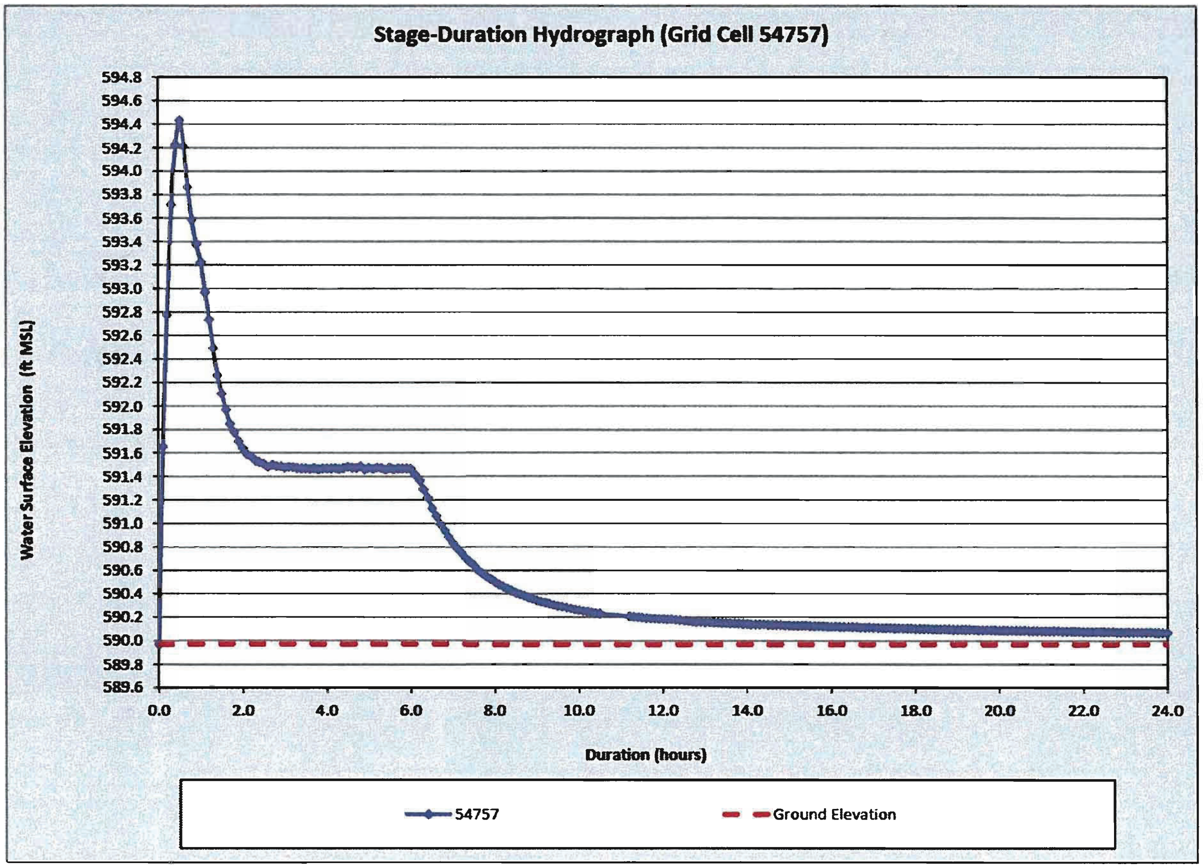

Figure C-4: Grid Element 54757 Hydrograph