

Attachment D

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MEMO

To: Nathaniel Milam, P.E. (Whitson Engineers)
 From: Tarick Abu-Aly, P.E.
 Date: March 22, 2022

Subject: Addendum to Potential Impacts to the State Parks Barn Complex Due to the Carmel River Floodplain Restoration and Environmental Enhancement Project

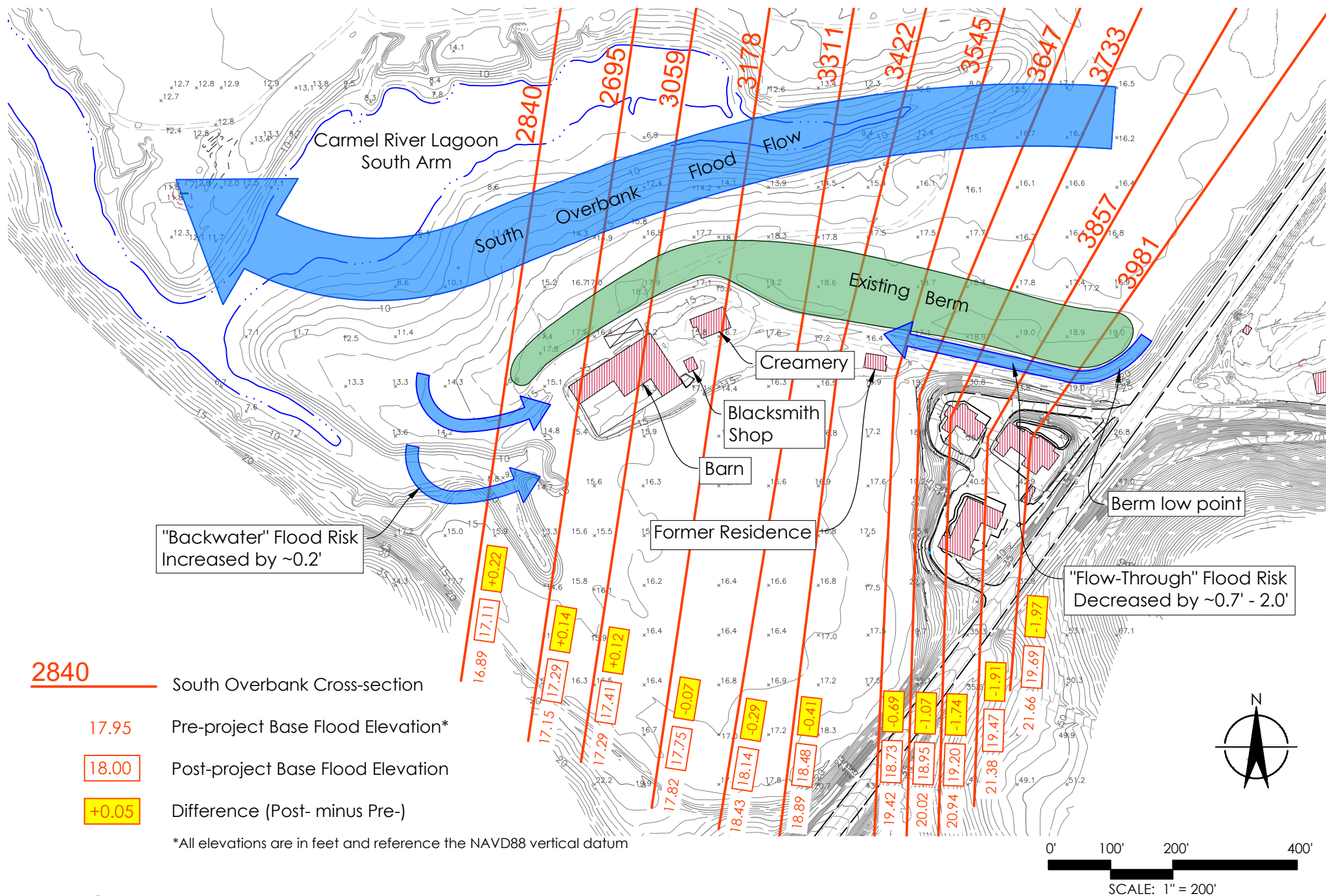
In September of 2016, Balance Hydrologics submitted a memo summarizing the potential impacts to the State Park Barn Complex located west of the proposed Highway 1 Causeway Bridge (**Attachment A**). The Base Flood Elevations (BFEs) published in the memo were based on hydraulic modeling of pre- and post-project conditions performed by Balance in 2015. Since then, Balance has kept the hydraulic model updated as the design plans have progressed. More recently in 2021, as part of an effort to obtain a Conditional Letter of Map Revision (CLOMR) from the Federal Emergency Management Agency (FEMA), the hydraulic model was revised based on minor design changes and comments received from FEMA. The revised pre- and post-project hydraulic models and associated BFEs have been tentatively approved by FEMA and, although we have not received the final CLOMR yet, the model results can be considered “draft final”.

As an addendum to the prior memo, we have updated **Table 1** and **Figure 1** to reflect the most recent modeled BFEs and revised target First Floor Elevations (FFE). Although the BFEs have changed slightly, the flood risk mitigation recommendations of the 2016 memo still apply.

Table 1: Revised Pre- and Post-Project BFEs

Building	Existing FFE (ft) ¹	LAG (ft)	Pre-Project BFE (ft)	Post-Project BFE (ft)	Target FFE (ft)
Barn	17.7 (concrete floor, southern bay)	17.1 (next to concrete floor) 14.3 (next to NE corner)	17.29	17.41	18.41
Blacksmith Shop	18.5	16.1	17.63	17.63	18.63
Creamery	16.7 (western addition, slab on grade) 17.3 (eastern addition, slab on grade) 17.5 (raised wood floor)	15.5	17.82	17.75	18.75
Former Residence	18.7	16.0	19.16	18.61	19.61

¹All elevations in this addendum and the original 2016 memo reference the North American Vertical Datum of 1988 (NAVD88)



ATTACHMENT A

STATE PARKS BARN COMPLEX IMPACTS MEMO 09-15-2016

MEMO

To: Nathaniel Milam, P.E. (Whitson Engineers)
From: Anna Nazarov, P.E., CFM, Edward D. Ballman, P.E.
Date: September 15, 2016

Subject: Potential Impacts to the State Parks Barn Complex Due to the Carmel River Floodplain Restoration and Environmental Enhancement Project

In August of 2015, Balance Hydrologics reviewed the hydraulic modeling analyses prepared for the Carmel River Floodplain Restoration and Environmental Enhancement (CRFREE) Project and summarized anticipated changes in downstream flood elevations in a technical memo. The focus of that review was on Base Flood Elevations (BFEs), also known as 100-year flood elevations, since they are the primary regulatory standard for County ordinances and regulations under the National Flood Insurance Program. This memo builds off of that work to summarize the potential impacts at the State Park Barn Complex located west of the proposed Causeway.

Existing Conditions

The State Parks Barn Complex is located west of Highway 1. These buildings are known as the Barn, the Blacksmith Shop, the Creamery, and the Former Residence, and can be seen on Figure 1. All four are currently mapped in a FEMA 100-year floodplain since the existing berm along the north edge of the property does not provide full flood protection and does not meet FEMA's levee accreditation standards. As a result, the structures are subject to a FEMA mapped risk, which represents the worst case scenario (i.e., it's mapped as if the berm does not exist).

Unlike the FEMA mapping methodology, the actual flood risk (and the question of actual project impact) is determined by several factors: the ability of the existing berm to remain intact during the design 100-year flood event; flooding potential from the east (flow-through flooding), and flooding potential from the west (backwater flooding). Balance has not performed the detailed seepage, stability, and scour analyses needed to determine if the berm is able to provide flood protection during the 100-year event. For the analysis of the two types of risk that follows, it is assumed that the berm would not fail during the 100-year event.

1. **Flow-Through Flooding Risk.** While the top of berm is, in general, above or just at the existing 100-year BFE, a low point exists near Highway 1 (see Figure 1). Under existing conditions, the modeled BFE at this low point is 19.8 feet compared to a low ground elevation of just under 18.0 feet based on best available topographic data. Actual flood elevations at the Barn Complex would be expected to be lower than this modeled elevation because the 100-year peak flow would likely not crest long enough and the low point would not be wide enough to equalize the water surface elevations on the inboard

and outboard sides of the berm. Instead, this flooding risk represents a high velocity, “flow-through” risk to the structures.

2. **Backwater Flooding Risk.** The Barn Complex is also subject to shallow backwater flooding from the west up to an elevation of 16.9 feet.¹ Unlike the high velocity flow that could be expected through the low point in the berm, this represents a stillwater elevation.

Post-Project Conditions

While some water surface elevations are expected to decrease with the construction of the Causeway, all four properties would still be mapped in the FEMA 100-year floodplain unless substantial work is completed to convert the berm to a FEMA-certified levee with the appropriate freeboard and structural integrity. The pre- and post-project mapped BFEs are shown on the cross-sections in Figure 1.

Again, if we assume that the existing berm could withstand the 100-year event, we can assess the residual risk to the structures:

1. **Flow-Through Flooding Risk.** The aforementioned flow-through risk decreases for all structures as the post-project BFE at the low point in the berm upstream of the Barn Complex is decreased by 0.5 feet².
2. **Backwater Flooding Risk.** Due to the larger volume of flow that will be routed under the Causeway and out to the South Arm of the Carmel Lagoon, the backwater flooding elevation increases by 0.2 feet (from elevation 16.9 to 17.1 feet) immediately downstream of the berm protecting the Barn Complex.

Improvement Options

Several options to mitigate the two types of flooding risk are available, including:

1. **Flow-Through Flooding Risk.** Although the flow-through flooding risk decreases with the construction of the Causeway, it is not fully eliminated. One option is to eliminate the flow-through risk altogether by improving the existing berm to provide additional freeboard and closing off the low point that allows flow-through flooding.
2. **Backwater Flooding Risk.** Backwater flooding risk will remain unless a) the existing berm is improved as above and the protection is extended around the west and south boundaries of the Barn Complex with a berm or a low flood wall or b) the affected buildings and/or the entire site is elevated.

Improving the exiting berm is a relatively inexpensive option that would involve adding additional fill to the existing berm to provide freeboard and protect from the high velocity

¹ This backwater flooding originates in the South Arm of the Carmel Lagoon and would impact the site from the southwest coming around the end of the berm, since it does not fully enclose the area on the west and south.

² Counterintuitively, 100-year elevations on the downstream side of the proposed Causeway are expected to decrease when compared to existing conditions. In existing conditions, water must pond on the upstream side of Highway 1 before spilling over the top of the roadway. The Causeway will allow for more natural water conveyance, reducing flood elevations when compared to the presently-mapped “waterfall” condition over Highway 1.

flooding risk. This option would eliminate the flow-through flooding, but would not affect the backwater flood elevation of 17.1 feet just downstream of the berm. Extending the berm around the west and south is expected to be more expensive due to the length of required new berm/floodwall. This option has the potential to eliminate the backwater flooding risk, but would have some limited riparian habitat impact along the west side of the Barn building. This impact would require separate mitigation and compensatory habitat planting, which would contribute to the cost. Elevating the structures is likely the costliest, but would protect the elevated buildings from both mapped and actual flooding risk if completed in accordance with Monterey County's floodplain ordinance requirements.

Whitson Engineers' survey crew visited the property on September 12, 2016 to assess the existing first floor elevations (FFE) for the four buildings. They are shown in the following table along with the lowest adjacent grade (LAG), the modeled pre and post-project 100-year BFEs, and the recommended target elevation that each building's first floor should be elevated to in order to comply with Monterey County's floodplain ordinance requirement of one foot above the BFE.

Building	Existing FFE (ft)	LAG (ft)	Pre-Project BFE (ft)	Post-Project BFE (ft)	Target FFE (ft)
Barn	17.7 (concrete floor, southern bay)	17.1 (next to concrete floor) 14.3 (next to NE corner)	17.2	17.3	18.3
Blacksmith Shop	18.5	16.1	17.5	17.5	18.5
Creamery	16.7 (western addition, slab on grade) 17.3 (eastern addition, slab on grade) 17.5 (raised wood floor)	15.5	17.6	17.6	18.6
Former Residence	18.7	16.0	18.5	18.3	19.3

As the table shows, the post-project BFE (the mapped flooding risk) is expected to increase by 0.1 feet in the vicinity of the barn. No change in mapped flooding risk is expected at the Blacksmith Shop and the Creamery. The Former Residence should expect to see a 0.2-foot reduction in BFE (see footnote 2 above).

Regardless of whether changes in the mapped risk are expected, the existing FFEs of the Barn, the Blacksmith Shop, and the Former Residence buildings are higher than both the pre- and post-project BFEs³. These FFEs are also higher than the pre- and post-project backwater elevations of 16.9 and 17.1 feet, respectively. Without improvements to the berm, the buildings are still subject to flow-through flooding, but the risk is reduced in the post-project scenario as the flood elevation at the low point in the berm decreases from 19.8 to 19.3 feet. Therefore, the CRFREE

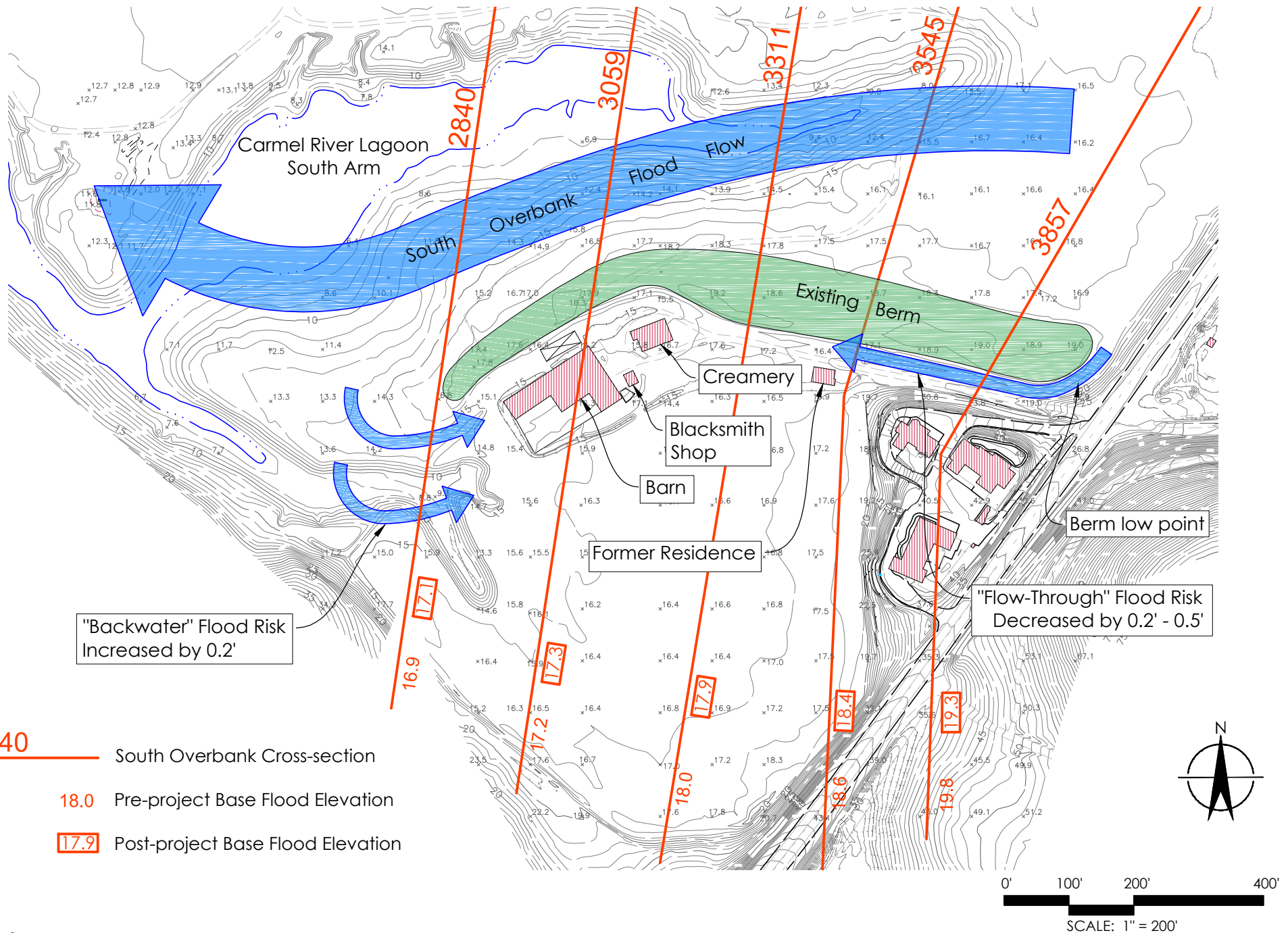
³ While the Blacksmith Shop does appear to have the required one foot of freeboard, the survey crew noted that it is presently elevated on blocks. While this provides the required freeboard, it does not provide adequate protection from velocity flows through the site and would not be considered properly anchored based on the floodplain ordinance requirements.

project does not expose these structures to a significantly increased risk of flooding with respect to FFEs during the 100-year event.

While the Creamery first floors (slab on grade and raised wood floor portions) are below the pre-project BFE, the CRFREE project does not increase the BFE at this location. The western addition of this building is subject to backwater flooding in pre-project conditions (flooding elevation of 16.9 feet compared to an FFE of 16.7 feet). Without further improvements, this risk is increased by 0.2 feet as the post-project backwater elevation increases to 17.1 feet. Similarly to the other buildings, the Creamery is subject to flow-through flooding if no berm improvements are made, but the risk is reduced in the post-project scenario.

Closing

If you have any additional questions about this memo, please do not hesitate to contact us.



**Balance
Hydrologics, Inc.**

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Figure 1. 100-year flood risk assessment at the State Parks Barn Complex, Monterey County, California.