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TECHNICAL MEMORANDUM

To: Todd Smith – Sacramento County Planning Department

From: Ken Giberson

Cc: Michael Johnson – Sacramento County DWR

Date: December 5, 2018

Subject: Climate Change Impact Analysis
For NewBridge Specific Plan Development

1. INTRODUCTION

NewBridge Specific Plan (NewBridge) is a large planning area that is in the watershed of Laguna Creek (Frye Creek) and the Morrison Creek Stream Groups. Recently, Sacramento County expressed concern regarding the potential long-term effect climate change may have on the proposed drainage and flood control improvements within NewBridge.

Traditional methods for estimating the flow rate for the 10-year and 100-year design events assume that flow rate will not change over time. The drainage and flood control facilities included in the NewBridge Drainage Master Plan were predicated on this assumption.

However, the uncertainty associated with climate change indicates that the potential for flow rates to vary over time needs to be addressed. Current understanding, supported by research and broad consensus of the scientific community, is that our climate is changing. This means that flood hazard, which is driven partially by climate, will also change.

Additionally, some stakeholders have expressed concern that the NewBridge development has not addressed the 200-year design event. The threat of flooding from the 200-year event as a design standard is applicable to some, but not all, developing areas within Sacramento County. The applicability of the 200-year design standard for NewBridge needs some discussion.

2. PROBLEM STATEMENT

The NewBridge development is currently undergoing environmental review by Sacramento County in conjunction with land use entitlement applications that have been filed by the applicant. Notwithstanding the existence of an approved drainage master plan for the NewBridge development, the extent of additional

flooding that may occur within and downstream of NewBridge during the 10-year and 100-year events assuming the affects of climate change has been requested. Additionally, the applicability of Sacramento County's 200-year design standard needs to be addressed.

3. METHODOLOGY

Currently, Sacramento County doesn't require proposed drainage and flood control improvements to be designed to withstand the effects of climate change. Additionally, the long-term effects of climate change have not been quantified with a reasonable degree of precision at this time. Accordingly, today it is beyond the ability of the engineering community to predict the probable magnitude of climate change on local hydrology.

In the absence of adopted hydrologic design standards for climate change, a reasonable approach to evaluating the effects on climate change on the flood control improvements proposed for NewBridge needs to be developed. In essence, these proposed NewBridge improvements need to be evaluated for their resiliency to withstand the additional flows that may be generated from the effects of climate change.

The precipitation and runoff characteristics of the NewBridge project area under existing and development conditions was extensively modeled during the preparation of the Drainage Master Plan for the project. The SacCalc precipitation modeling for the project yielded the total volume of runoff and peak flow for both the pre and post development scenarios.

The resulting hydrographs were analyzed from the pre-project to the post-project conditions and input into the HEC-RAS models for Frye Creek for evaluation of the proposed flood control improvements. The SacCalc and HEC-RAS models were used to determine the adequacy of the facilities tributary to each watershed to accommodate the resultant flows during the 10-year and 100-year design events during climate change conditions. The results of the Master Plan analysis indicated that the facilities provide the required level of protection from the 10-year/24-hour, the 100-year/24-hour, and the 100-year/10-day design events.

The methodology to be used to check the resiliency of the NewBridge drainage and flood control facilities to endure the effects of climate change will incorporate climate change influences on the existing-climate discharge frequency curves from the Central Valley Flood Protection Project (CVFPP) derived by the California Department of Water Resources (DWR) for the CVFPP in 2017. [1] California DWR estimated the impacts that climate change may have on the runoff from various creek systems in the Central Valley.

The California DWR analysis can be used to derive hydrologic scaling factors from the climate change analysis. Scaling factors were derived from this analysis

[1] California Department of Water Resources, *2017 CVFPP Update – Climate Change Analysis Technical Memorandum* (March 2017)

for three design events (10-year, 100-year and 200-year events) and five (5) different durations (1, 3, 7, 15 and 30-days).

These scale factors will be used to adjust the existing hydrographs from the NewBridge Drainage Master Plan to estimate the resultant climate-changed flow conditions that are projected to occur over time as a result of climate change. That is, the scale factors will be used to increase the predicted hydrographs previously derived from the SacCalc precipitation modeling mentioned above.

Sacramento County DWR requested a bookend approach to evaluating the resiliency of the projected NewBridge flood control improvements. Sacramento County suggested using the scaling factors for Arcade Creek and Pleasant Gove Creek Canal (PGCC) during the preparation of this Technical Memorandum. Sacramento County DWR suggested that the differences in scaling factors between these two creeks should provide an adequate range of impacts for analysis for this level of study.

The scaling factors for the two creeks is shown below in Tables 1 and 2. Note that the 10-Day volume scaling factors were derived by straight line interpolation from the 7-Day and 15-Day Volumes.

Table 1
Scaling Factors for Arcade Creek

Annual Exceedence Probability	Return Period (Yr.)	Arcade Creek Scaling Factors					
		Derived from California DWR Analysis					
		1-Day Volume	3-Day Volume	7-Day Volume	15-Day Volume	30-Day Volume	**10-Day Volume (Calc.)**
0.005	200	0.99	1.06	1.13	1.26	1.32	**1.18**
0.01	100	1.08	1.14	1.21	1.31	1.36	**1.25**
0.1	10	1.46	1.44	1.48	1.50	1.50	**1.49**

Note: 10-Day Volume Scaling Factors were derived by straight line interpolation between the 7-Day and 15-Day Volumes .

The scaling factors for the 10-year and 100-year events will be used to estimate the climate-changed hydrographs for the watersheds within the NewBridge project. These adjusted hydrographs will then be input into the approved HEC-RAS models for the project to determine a range of the effects that climate change might have on the proposed improvements.

Table 2
Scaling Factors for Pleasant Grove Creek Canal

Annual Exceedence Probability	Return Period (Yr.)	Pleasant Grove Creek Canal Scaling Factors					
		Derived from California DWR Analysis					
		1-Day Volume	3-Day Volume	7-Day Volume	15-Day Volume	30-Day Volume	**10-Day Volume (Calc.)**
0.005	200	1.60	1.53	1.38	1.28	1.25	**1.34**
0.01	100	1.54	1.48	1.36	1.27	1.24	**1.33**
0.1	10	1.35	1.32	1.25	1.22	1.20	**1.24**

Note: 10-Day Volume Scaling Factors were derived by straight line interpolation between the 7-Day and 15-Day Volumes.

The threshold of significance for evaluating these effects on the resiliency of the proposed improvements to withstand climate change are listed below:

1. Detention Basins:
    a. Freeboard encroachment is permissible so long as top of berm elevations are not exceeded.
    b. Use of spillways is permissible so long as the capacity of the spillway is not exceeded (assuming no freeboard).
2. Creeks:
    a. Freeboard encroachment is permissible so long at the top of channel elevations are not exceeded (assuming no freeboard).
    b. Flooding of proposed building pads will not be allowed (1' minimum freeboard from water surface elevation to pad elevation will be maintained.)
3. Compliance Points
    a. Peak flows and stages at downstream compliance points does not exceed the flow rate and stage of pre-development levels assuming the effects of climate change on existing conditions.

One upstream watershed contributes flows at the north end of the NewBridge project area. Flow from the Mather South Specific Plan enters the NewBridge project area through a pipe to Detention Basin No. 7. The climate change factors were applied to the contributing watershed.

NewBridge is located at the top of five watersheds (Morrison Creek, Elder Creek, Frye Creek and two separate discharges to Laguna Creek). Four of these five watersheds are severed by downstream open channel systems that have the natural capacity to accept additional runoff from the project area during climate change. The one exception is the downstream conveyance system that serves Detention Basin No. 11.

Detention Basin No. 11 is located along the eastern edge of NewBridge adjacent to the Folsom South Canal (FSC). Discharge from Detention Basin No. 11 drains into a closed conduit, or culvert, that crosses over FSC before discharging into Laguna Creek. This closed conduit actually acts as a flume to convey these flows.

Regardless of climate change scenario, this closed conduit, or flume, likely has restricted ability to accept additional runoff from Detention Basin No. 11 without a corresponding increase in capacity. The replacement and/or upsizing of the flume is likely impractical from a cost, regulatory and logistics perspective.

Accordingly, a greater level of analysis of the impacts of climate change on Detention Basin No. 11 will be required rather than a simple comparison of pre and post development runoff flows. The results of this additional analysis will be discussed later in this Technical Memorandum.

4. CLIMATE CHANGE ANALYSIS

The approved existing conditions and developed conditions HEC-RAS models for NewBridge were modified to include the climate changed scaling described above. For Frye Creek twelve (12) model scenarios were made for the purposes of scaling the storms to account for climate change.

The additional scenarios (model plans) are as follows:

a. Frye Creek Model
    i. Arcade Creek Scaling Factor
        1. Existing Climate Changed 10-Year/24-Hour Model.
        2. Existing Climate Changed 100-Year/24-Hour Model
        3. Existing Climate Changed 100-Year/10-Day Model
        4. Proposed Climate Changed 10-Year/24-Hour Model.
        5. Proposed Climate Changed 100-Year/24-Hour Model
        6. Proposed Climate Changed 100-Year/10-Day Model
    ii. PGCC Scaling Factor
        1. Existing Climate Changed 10-Year/24-Hour Model.
        2. Existing Climate Changed 100-Year/24-Hour Model
        3. Existing Climate Changed 100-Year/10-Day Model
        4. Proposed Climate Changed 10-Year/24-Hour Model.
        5. Proposed Climate Changed 100-Year/24-Hour Model
        6. Proposed Climate Changed 100-Year/10-Day Model

Several compliance points were established in the approved Master Plan for purposes of comparison of pre and post development flows leaving the project area. See Figure 1. These same compliance points were used in this analysis to compare pre and post development climate change flows. The compliance point results of this modeling exercise are shown in Tables 3 and 4 below. Table 5 shows the basin information and model results.

The flows exiting Detention Basin No. 11 are measured at CP 8, immediately upstream of the existing culvert over FSC. A conservative estimate of the capacity of the culvert is approximately 35± cfs assuming no head at the culvert's entrance.

Table 3
Compliance Point Table Arcade Scaling Factors

Arcade Scaled Flows	Existing Conditions			Developed Conditions		
	10-yr/ 24-hr	100-yr/ 24-hr	100-yr/ 10-day	10-yr/ 24-hr	100-yr/ 24-hr	100-yr/ 10-day
CP1	314	361	304	220	289	267
CP2	281	328	256	150	215	207
CP3	44	52	35	42	50	33
CP4	28	34	17	25	31	16
CP5	37	45	23	18	24	11
CP6	28	34	18	2.2	21	**20**
CP7	50	59	41	26	47	36
CP8	57	67	46	16	39	37
CP9	15	19	9.1	9.1	17	**10**
CP10	41	50	28	4.6	17	15
CP11	108	130	78	25	71	57
CP12	33	40	21	2.2	21	20
CP13	12	15	6.4	2.7	5.5	4.8

Note: Bold & Yellow Highlighted Results Exceed Existing Conditions Flows.

The results of climate change analysis as it relates to this culvert are summarized in Table 6 below. Due to the limited capacity of the existing culvert, it is likely its capacity may be exceeded during climate change conditions without further mitigation, especially when using the PGCC Scaling Factors.

One or more of the following design options could be used to improve the performance of this basin and achieve the required mitigation:

1. Refined analysis of capacity of existing culvert,
2. Allow hydraulic head on culvert to increase its capacity,
3. Increase the volume efficiency ratio of current basins design, and/or

4. Increase basin area and/or depth.

Based on this analysis, several observations can be made regarding the resiliency of the proposed flood protection improvements within the NewBridge project to withstand the additional flows resulting from climate change.

a. Under the Arcade Creek scaling scenario most basins continue to have 1-foot of freeboard, Detention Basin No. 7 and Detention Basin No. 11 do not have 1-foot of freeboard.

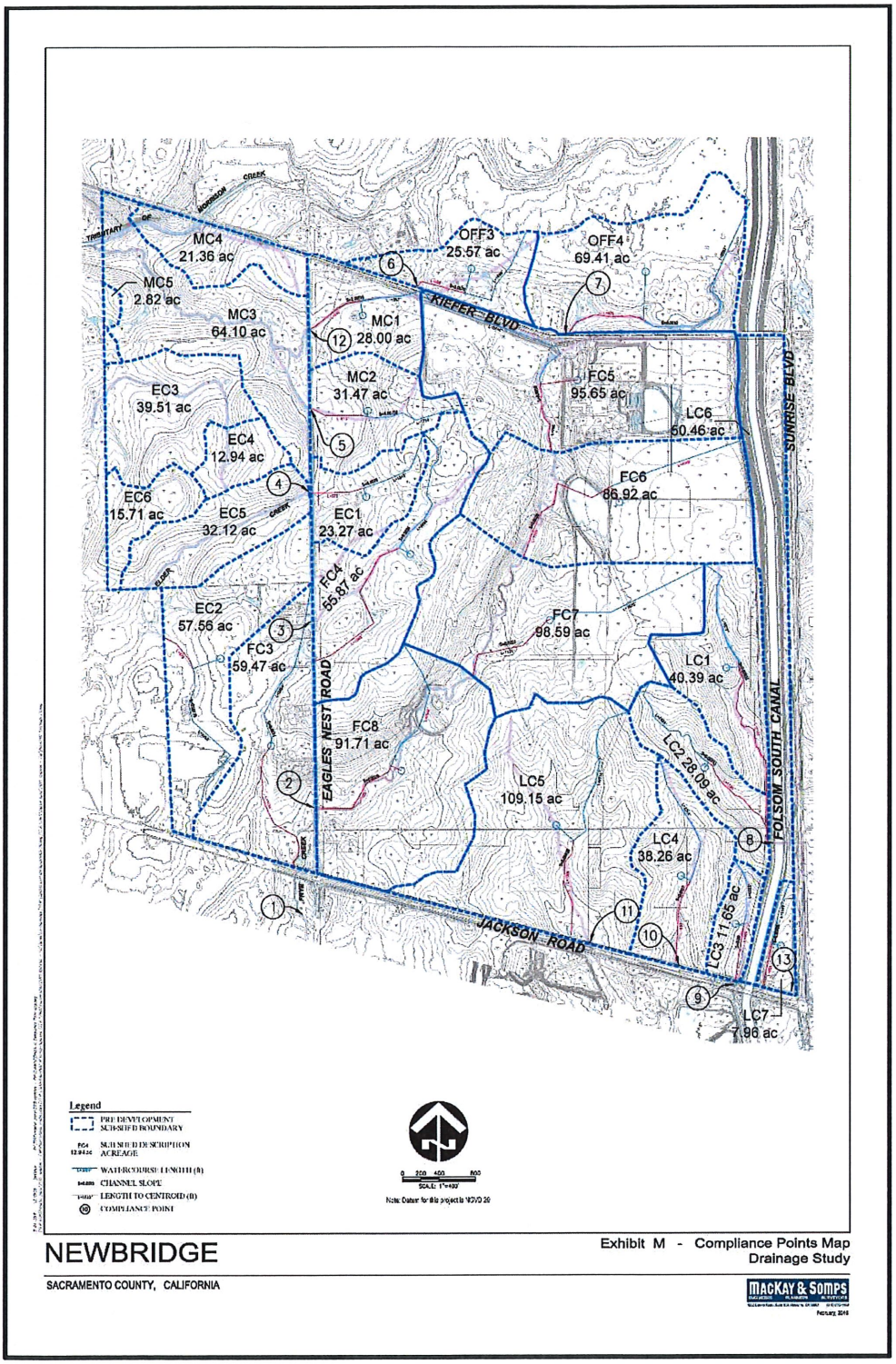
b. Under the PGCC scaling scenario water surface elevations in the basins will encroach into the freeboard for the 100-year 24-hour event.

Table 4
Compliance Point Table PGCC Scaling Factors

PGCC Scaled Flows	Existing Conditions			Developed Conditions		
	10-yr/ 24-hr	100-yr/ 24-hr	100-yr/ 10-day	10-yr/ 24-hr	100-yr/ 24-hr	100-yr/ 10-day
CP1	288	484	332	203	386	282
CP2	255	480	277	138	322	218
CP3	40	77	37	38	73	36
CP4	25	49	18	23	45	17
CP5	34	65	25	17	42	12
CP6	26	50	20	1.5	28	**21**
CP7	46	87	44	21	86	41
CP8	52	97	49	11	56	39
CP9	14	27	9.8	6.5	**29**	**11**
CP10	38	72	30	4	45	18
CP11	100	188	83	19	149	62
CP12	30	58	22	1.5	28	21
CP13	11	21	6.9	1.9	6.8	5

Note: Bold & Yellow Highlighted Results Exceed Existing Conditions Flows.

Figure 1
Compliance Point Exhibit



Source: Storm Drain Master Plan for NewBridge (July 27, 2017)

Table 5
Basin Information & Model Results

Basin Information (Master Plan)											100-Year 24-Hr		10-Year 24-Hr		100-Year 10-Day	
Basin Number	Modeling Number	Basin Bottom Elevation	Hydromod Bot. Flow Orifice Size	Hydromod Low Flow Orifice Size	Hydromod Mid Flow Orifice Size	Hydromod High Flow Orifice Size	Top of Hydromod Riser Elev.	Top of Berm Elevation	Basin Volume w/ Freeboard (Ac. Ft.)	Basin Volume No Freeboard (Ac. Ft.)	100-year Storage (Arcade Gage)	100-year Storage (PGCC Gage)	10-year Storage (Arcade Gage)	10-year Storage (PGCC Gage)	10-Day Storage (Arcade Gage)	10-Day Storage (PGCC Gage)
1	DETB1	123	0.5' x 0.2' @ 123'	N/A	1' x 0.75' @ 127'	N/A	128	130.5	3.5	4.2	**3.5**	**3.7**	**3.3**	**3.2**	**3.0**	**3.0**
2	DETB2	123	0.25' x 0.25' @ 123'	N/A	N/A	N/A	127	130	2.7	3.3	**2.7**	**2.9**	**2.6**	**2.5**	**2.3**	**2.4**
3	DETB3	130	0.3' x 0.3' @ 123'	N/A	N/A	N/A	133	136.5	2.4	3.1	**2.3**	**2.5**	**2.1**	**1.9**	**2.0**	**2.1**
4	DETB4	130	0.5' x 0.3' @ 130'	N/A	N/A	N/A	133.5	137	5.6	6.7	**5.6**	**6.3**	**5.1**	**4.9**	**4.2**	**4.3**
5A	DETB5A	133.5	0.25' x 0.25' @ 133.5'	N/A	N/A	N/A	136	139	2	2.5	**1.9**	**2.1**	**1.5**	**1.4**	**1.6**	**1.7**
5B	DETB5B	136	0.25' x 0.25' @ 133.5'	N/A	N/A	N/A	138.5	141.7	1.2	1.6	**0.8**	**1.0**	**0.7**	**0.7**	**0.7**	**0.7**
7	DETB7	136	1' x 0.6' @ 136'	N/A	N/A	N/A	141	141.5	47.1	55.4	**48.0**	**51.0**	**41.0**	**40.0**	**46.0**	**47.0**
8	DETB8	138	0.4' x 0.2' @ 138'	N/A	0.7' x 0.4' @ 140.5'	N/A	142	144.5	7	8.7	**5.2**	**6.0**	**3.1**	**2.9**	**4.9**	**5.0**
9	DETB9	137	0.3' x 0.2' @ 137'	N/A	N/A	1' x 1' @ 140'	141.5	144.5	13.2	15.6	**9.7**	**11.0**	**6.9**	**6.5**	**9.6**	**9.8**
10	DETB10	120.7	0.5' x 0.2' @ 120.7'	N/A	1' x .5' @ 122.7'	N/A	126.7	129.2	13.4	15.9	**12.0**	**14.0**	**8.9**	**8.1**	**11.0**	**12.0**
11	DETB11	123.6	0.5' x 0.2' @ 123.6'	N/A	N/A	1' x 1' @ 126.6'	129.1	131.6	11.9	13.9	**12.0**	**15.0**	**10.0**	**9.8**	**12.0**	**12.0**
12	DETB12	123	0.4' x 0.2' @ 123'	N/A	N/A	N/A	127.5	132	5.6	6.6	**4.8**	**5.8**	**4.1**	**3.8**	**4.5**	**4.7**
13	DETB13	117.5	0.5' x 0.4' @ 117.5'	N/A	N/A	2' x 1' @ 121'	122.5	125.5	11.2	13.3	**11.0**	**12.0**	**8.7**	**8.4**	**9.6**	**10.0**
14	DETB14	117	0.5' x 0.5' @ 117'	0.5' x 0.5' @ 119'	0.5' x 0.5' @ 121'	N/A	122	125	6.2	7.4	**4.5**	**5.2**	**3.7**	**3.4**	**4.4**	**4.5**
15	DETB15	119.5	0.5' x 0.2' @ 119.5'	N/A	1' x 0.5' @ 123'	N/A	125	127	1.6	2	**1.4**	**1.6**	**1.3**	**1.3**	**1.3**	**1.3**
16	DETB16	115	0.17' x 0.17' @ 115'	0.17' x 0.17' @ 116'	0.17' x 0.17' @ 117'	N/A	118	121	2.1	2.6	**1.6**	**2.0**	**1.3**	**1.2**	**1.5**	**1.5**

Notes:
1. Values in Bold and Green Highlight represent Storage Volumes that have greater than or equal to Master Plan freeboard requirements.
2. Values in Bold and Yellow Highlight represent Storage Volumes that encroach into but don't exceed the Master Plan freeboard.
3. Values in Bold and Red Highlight represent Storage Volumes that exceed top of berm elevations (i.e., Volume overtops basin top of berm).

Table 6
CP8/Detention Basin No. 11/FSC Culvert Capacity Model Results

Design Event	Approved Master Plan		Arcade Creek Scaling Factors		PGCC Scaling Factors	
	Existing Conditions Flows	Developed Conditions Flows	Resultant Flows	Volume Increase to Achieve 35 cfs Max. Flow	Resultant Flows	Volume Increase to Achieve 35 cfs Max. Flow
10-Yr/ 24-Hr	37± cfs	7± cfs	16± cfs	No Change	11± cfs	No Change
100-Yr/ 24-Hr	62± cfs	35± cfs	39± cfs	±15%	56± cfs	±100%
100-Yr/ 10-Day	35± cfs	31± cfs	37± cfs	±15%	39± cfs	±15%

Note: Volume increases assume horizontal expansion of the basin only. Other design options may be available to achieve similar mitigation.

c. Under the PGCC scaling scenario for the 100-Year/24-Hour event, Detention Basin No. 11 overtops and the top of berm elevation will need to be raised slightly if the PGCC scaling factors become the climate change standard.

d. The project remains in compliance with peak discharge requirements in the Arcade and PGCC scaling scenarios except for CP6 and CP9.

e. The discharge out of Detention Basin No. 11 to the east (CP8) is not fully mitigated to the downstream capacity of the culvert crossing the Folsom South Canal in the event of climate change using the PGCC scaling factors.

f. Frye Creek remains in compliance under all conditions within the project limits.

Whether climate change manifests itself in flows within the NewBridge project area being closer in magnitude to those estimated using the Arcade Creek or those using Pleasant Grove Creek Canal (PGCC) scaling factors, it appears that the proposed flood control facilities can handle the projected climate change flows without overtopping the top of berm elevations of the basins.

The one exception is during the 100-year/24-hour event in Detention Basin No. 11. In this case, the storage-discharge curve for the basin is slightly exceeded in the worst-case climate change scenario. Additionally, the resultant discharge from the basin exceeds the limited capacity of the existing culvert crossing the Folsom South Canal.

If the PGCC scaling factors are adopted, then the proposed design of this basin would require a minor revision to prevent overtopping during the 100-year PGCC-scaled event and to limit the flows leaving the project site through the culvert prior to entering Laguna Creek. Prior to tentative map approvals, and once Sacramento County has adopted specific climate change design standards, the preliminary design of all facilities shown in the master plan should be studied for resiliency against the effect of climate change.

The overall design of NewBridge shows resiliency in mitigating peak flow discharged from the site during climate change. The flood control basins on the project will have water surface elevations encroach into the freeboard, which isn't problematic except in one case. The one basin of particular concern is Detention Basin No. 11 which does not adequately store the 100-year/24-hour PGCC scaled flows. Once a climate change standard has been adopted, the design of this basin can be modified as needed to prevent overtopping the basin top of berm elevation.

5. APPLICABILITY OF SCALING FACTORS

It should be noted that the watersheds of Arcade Creek and Pleasant Grove Creek Canal (PGCC) have significantly different hydrological characteristics. The Arcade Creek watershed, typical of many creeks in the greater Sacramento County area, has a watershed that consists of lower elevation valley topography with slight to moderate topographic relief.

On the other hand, the PGCC watershed consists of both Sacramento Valley and Sierra Nevada foothill topography. The foothill portion of the watershed contains a considerable amount of foothill areas with characteristically higher elevations and greater topographic relief.

Foothill areas typically receive significantly more precipitation than lower elevation valley areas. Additionally, there appears to be significant agreement among climate change experts that valley areas will see smaller increases in runoff as a result of climate change as compared to the foothill regions. Understandably, the use of PGCC climate change scaling factors in this Technical Memorandum predicts significantly higher runoff rates than the Arcade Creek scaling factors.

Notwithstanding the implications of greater runoff resulting from the use of PGCC scaling factors, the PGCC scaling factors do not appear to be representative of the hydrological conditions that could occur in NewBridge under climate change. Rather, the use of Arcade Creek scaling factors for the analysis

of the impacts of climate change in the NewBridge project area are more applicable. Accordingly, in our professional opinion, the results relating to the use of PGCC scaling factors in this Technical Memorandum are suspect.

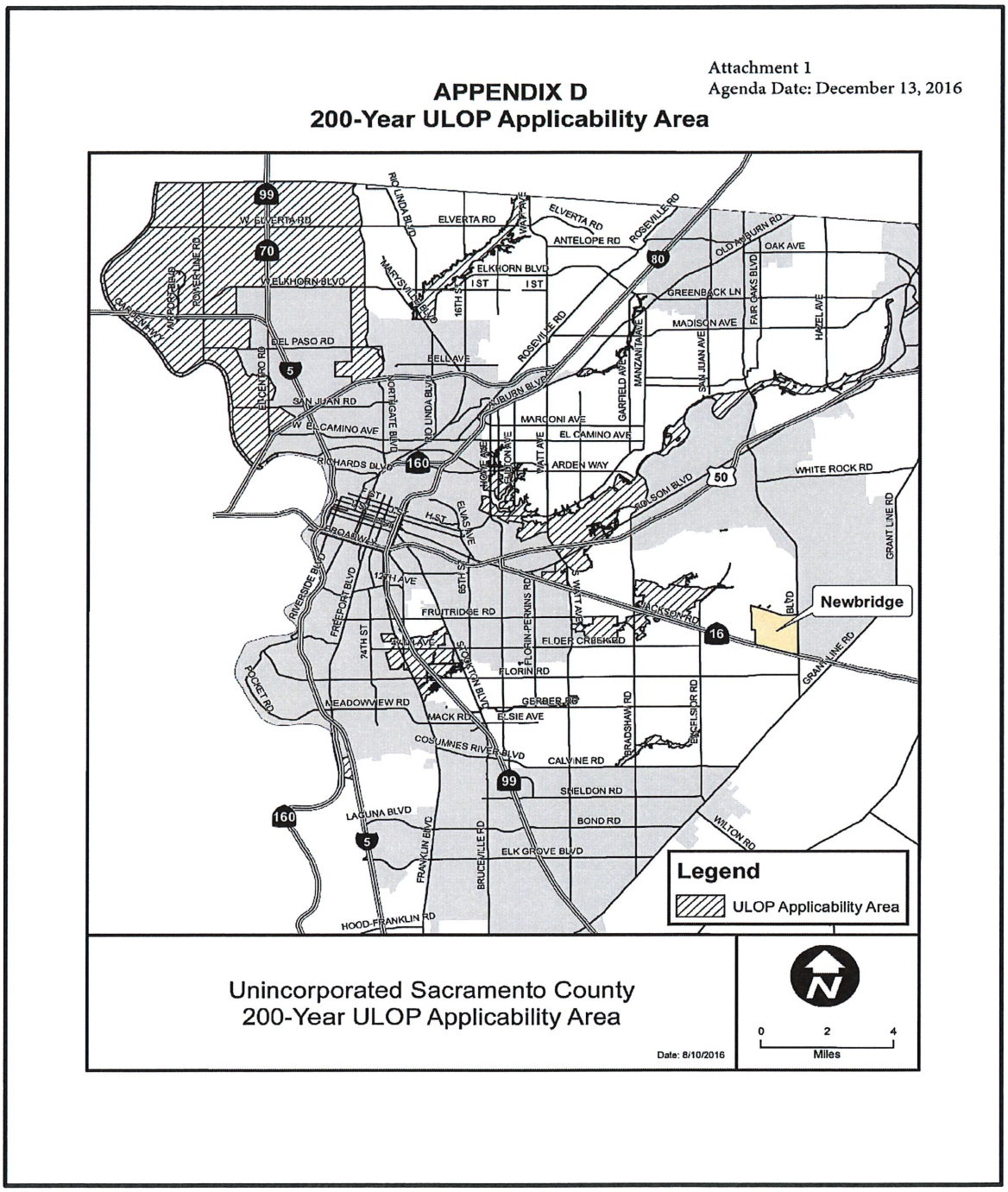
6. 200-YEAR LEVEL OF FLOOD PROTECTION

In compliance with the requirements of SB 5, and the requirements of the California Central Valley Flood Protection Board (CVFPB) for Urban Level of Flood Protection (ULOP), Sacramento County amended the Safety Element of the Sacramento County General Plan to address the need to protect urbanizing lands from the threat of flooding during the 200-year event.

During that adoption process, Sacramento County created a 200-Year ULOP Applicability Area exhibit (see Figure 2). Figure 2 shows the areas within the unincorporated areas of Sacramento County where the ULOP criteria for 200-year level of protection are applicable.

Inspection of Figure 2 clearly reveals that the NewBridge project area is not within the ULOP Applicability Area. Accordingly, the NewBridge project area is not required to provide ULOP mandated levels of flood protection.

Figure 2
200-Year ULOP Applicability Area



Source: Sacramento County General Plan Safety Element (December 13, 2016)

7. CONCLUSION

Flows increase under all climate change scenarios presented in this analysis. The result of this increase is an increased peak flow baseline in the existing conditions models.

Generally, the project continues to provide adequate mitigation to pre-project flows. The only exceptions to this are at two compliance points (CP6 and CP9). The design of the basins discharging to these two compliance points will require minor modification, including potential expansion, to address this increase in flow.

If scaling factors similar to the Arcade Creek scaling factors become the design standard of Sacramento County, there will be less total impact than what is found in the PGCC scaling factor models.

In addition to the compliance point peak flows, flow in Frye Creek was analyzed in the HEC-RAS models to determine if the resulting higher stages in the creek would exceed the design capacity of the facility. While the stages were found to have increased when subject to climate change analysis, the increased stages didn't encroach into the one-foot freeboard requirement.

In Frye Creek, the area of greatest concern is upstream of the road crossings which limit the flow downstream. Each of these crossings are sized large enough to not overtop the upstream channel banks. Nonetheless, if necessary, the design of the crossings can be modified to pass the increased flow from climate change if a lower upstream water surface elevation is desirable.

The volume changes resulting from the climate change scaling factors has a greater effect on the detention basins than on the peak flow. All detention basins continue to provide peak flow mitigation, but many basins no longer have one foot of freeboard. In one instance the basin overtops the banks during the PGCC scaling climate change model (Detention Basin No. 11). The design of this basin will need to be modified to include additional freeboard at the tentative map level design stage assuming a climate change scaling factor has been established as Sacramento County standard.

Based on the analysis presented in this Technical Memorandum, it is apparent that the approved drainage and flood control improvements for the NewBridge project have resiliency against the potential effects of climate change. Most of the facilities proposed in the Master Plan do not require modification to be effective even under the most conservative scaling factors for climate change. The design of those facilities which are not adequately sized for climate change can be modified with minor changes once a standard has been established. The preliminary climate change models established in this document do not present a scenario which is without solution.

This analysis demonstrates that the effects of climate change are not significant and that the project is not required to provide 200-year level flood protection.

Further, this analysis demonstrates that minor changes in the proposed design of proposed NewBridge drainage facilities are feasible if required. Any modifications to the proposed drainage and flood control facilities needed to accommodate the effects of climate change should be analyzed at the tentative map stage for the project.

Finally, as discussed above, the use of PGCC scaling factors is contraindicated in the case of NewBridge. Given the significant discrepancies that exist between the hydrologic characteristics of the PGCC and Arcade Creek watersheds, it seems that the use of Arcade Creek scaling factors is applicable to NewBridge than the use of PGCC scaling factors.

8. REFERENCES

The following documents were used as reference materials in the preparation of this Technical Memorandum:

a. 200-Year ULOP Applicability Area Exhibit for Unincorporated Sacramento County (Appendix D), December 13, 2016 (Sacramento County).

b. Flood Plain Management Ordinance, September 26, 2014 (Sacramento County).

c. 2030 General Plan of Sacramento County, November 9, 2011 (Sacramento County).

d. 2030 General Plan of Sacramento County – Safety Element, September 26, 2017 (Sacramento County).

e. Storm Drainage Master Plan for NewBridge, July 27, 2017 (MacKay & Somps Civil Engineers).

f. Urban Level of Flood Protection Criteria, November 2013 (California Department of Water Resources).