APPENDIX C:
HYDROLOGY RESULTS

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ACRONYMS

AFB	Air Force Base
NOAA	National Oceanic and Atmospheric Administration
RCP	Representative Concentration Pathway

C.1. STREAM CHANNEL MODELING

Modeling of stream channel overflow (or flood modeling) was conducted for Crutcho Creek using climate projection data for Representative Concentration Pathway (RCP) 4.5 and RCP 8.5 emission scenarios in 2030 and 2050. The scope of flood modeling was limited to stream channel networks and did not consider flooding of independent surface bodies, stormwater systems, or surface ponding.

C.1.1. Design Storms

A design storm is a hypothetical storm used to design infrastructure, evaluate flood hazards, and/or inform land use planning and resource management. Climate projections were used to estimate design storms for the projected emission scenarios and timeframes (Table C-1). Three-day storm events were used as design storms because rainfall occurring over consecutive days can cause soil saturation, overland flow, and compounding runoff which may result in flooding. The National Oceanic and Atmospheric Administration (NOAA) Atlas 14 was used to develop a synthetic distribution (hyetograph) for each design storm to use in flood modeling (Figure C-1). Design storms were based on annual events selected from ten years of data and therefore do not represent extreme weather events (e.g., hurricanes, extraordinary storm fronts) and are expected to be smaller than current 100-year storms.

Table C-1. Design storm precipitation.

Design Storm		Baseline	RCP 4.5		RCP 8.5	
		2000	2030	2050	2030	2050
Precipitation (inches)	Day 1	1.5	1.3	2.8	1.1	1.5
	Day 2	2.4	1.7	3.5	2.0	1.7
	Day 3	1.6	2.1	1.9	1.2	1.9
	Total	5.5	5.1	8.2	4.3	5.1
Percent change from baseline			-7%	49%	-22%	-7%

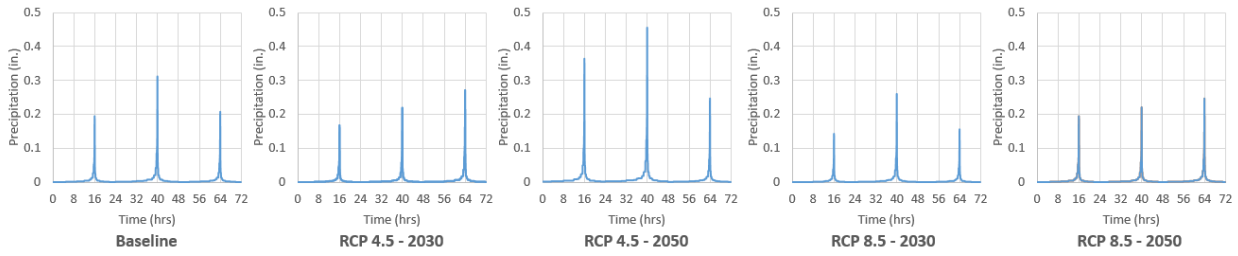

Figure C-1. Design storm hyetographs.

C.1.2. Flood Modeling

Design storms were used to model flooding along Crutcho Creek. The amount and timing of storm runoff depends on physical characteristics of the watershed including soil type, water table depth, land cover, topography, and channel characteristics. These variables were incorporated into a hydrologic model to simulate discharge following the projected storm events over the modeled watershed (Figure C-2).

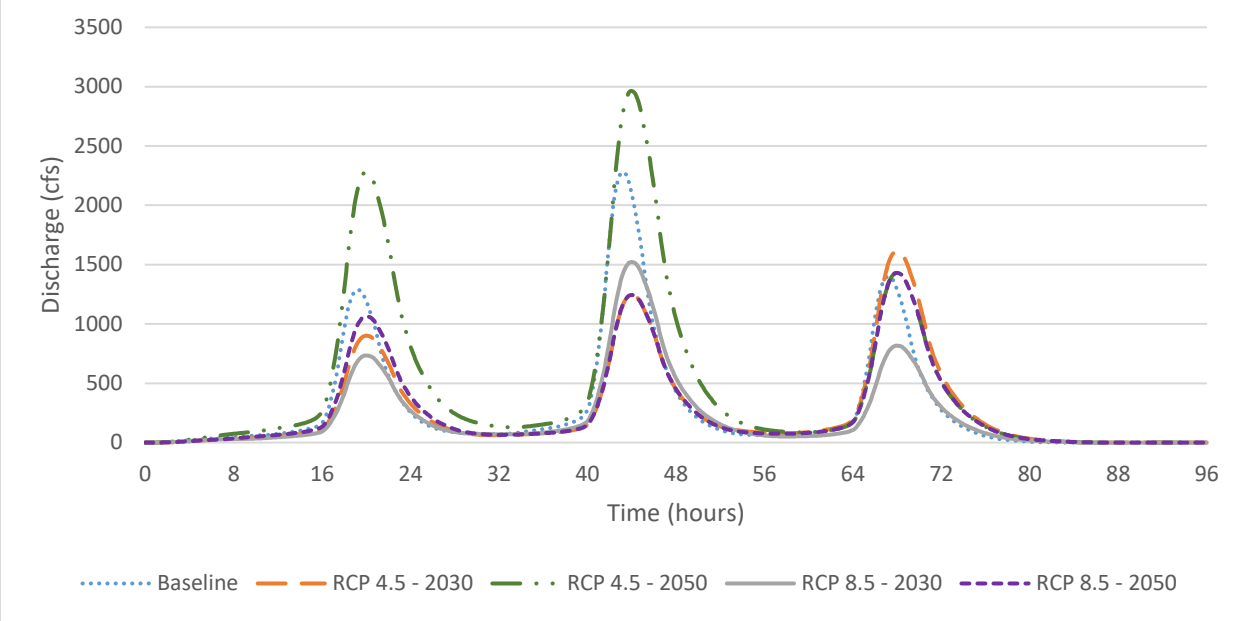

Figure C-2. Hydrographs for Crutcho Creek.

Storm hydrographs (Figure C-2), land cover data, environmental data, and elevation data were input into a hydraulic model to estimate inundation by stream channel overflow. Table C-2 summarizes projected inundation by area and percent change from baseline. Changes in projected inundation can be used to assess implications for infrastructure, vegetation, fish and wildlife species, and mission constraints.

Inundation projections were influenced by four variable inputs: (1) variation in total precipitation between design storms, (2) variation between the daily distribution of precipitation over the three-day period, (3) land cover change over the watershed area used in hydrologic modeling, and (4) land cover change in the area within the installation used in hydraulic modeling.

Within the hydrologic model, projected land cover type (variable input) intersected with soils (constant between scenarios) and depth to water table (constant between scenarios) to estimate friction, infiltration rate, and runoff rate, thus contributing to variability in results between scenarios. The variability in the results is then compounded because projected change in land cover within the hydraulic

model (installation area modeled) dictates the roughness coefficient (the path the water will take) which also has an effect on inundation.

In 2030, stream channel overflow is under the RCP 4.5 emission scenario is projected to not change from baseline conditions while under the RCP 8.5 emission scenario, inundation is projected to decrease by 15% (Figure C-3). In 2050, inundation is projected to increase by 16% under the RCP 4.5 scenario but decrease by over 70% under the RCP 8.5 scenario (Figure C-4). Land cover over the Crutcho Creek watershed is projected to be dominated by woodland/forested areas under the RCP 8.5, 2050 climate scenario, affecting runoff and inundation estimates (Table C-2).

Table C-2. Projected inundation from stream channel overflow at Tinker AFB.

	Baseline	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	190.3	190.3	221.1	161.4	51.6
Change in inundation area from baseline (acres)		0	30.8	-28.9	-138.7
Percent change from baseline		0%	16%	-15%	-73%

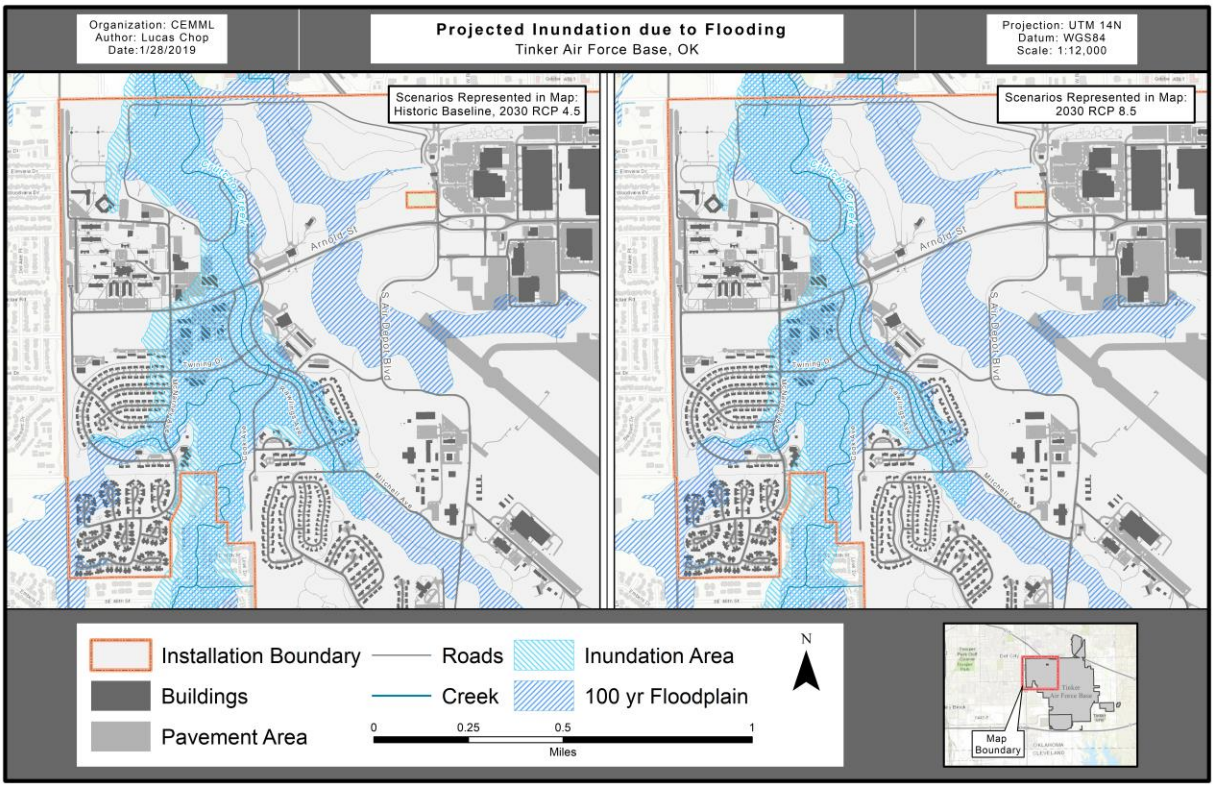

Figure C-3. Stream channel overflow for baseline conditions and RCP 4.5 and RCP 8.5 emission scenarios in 2030.

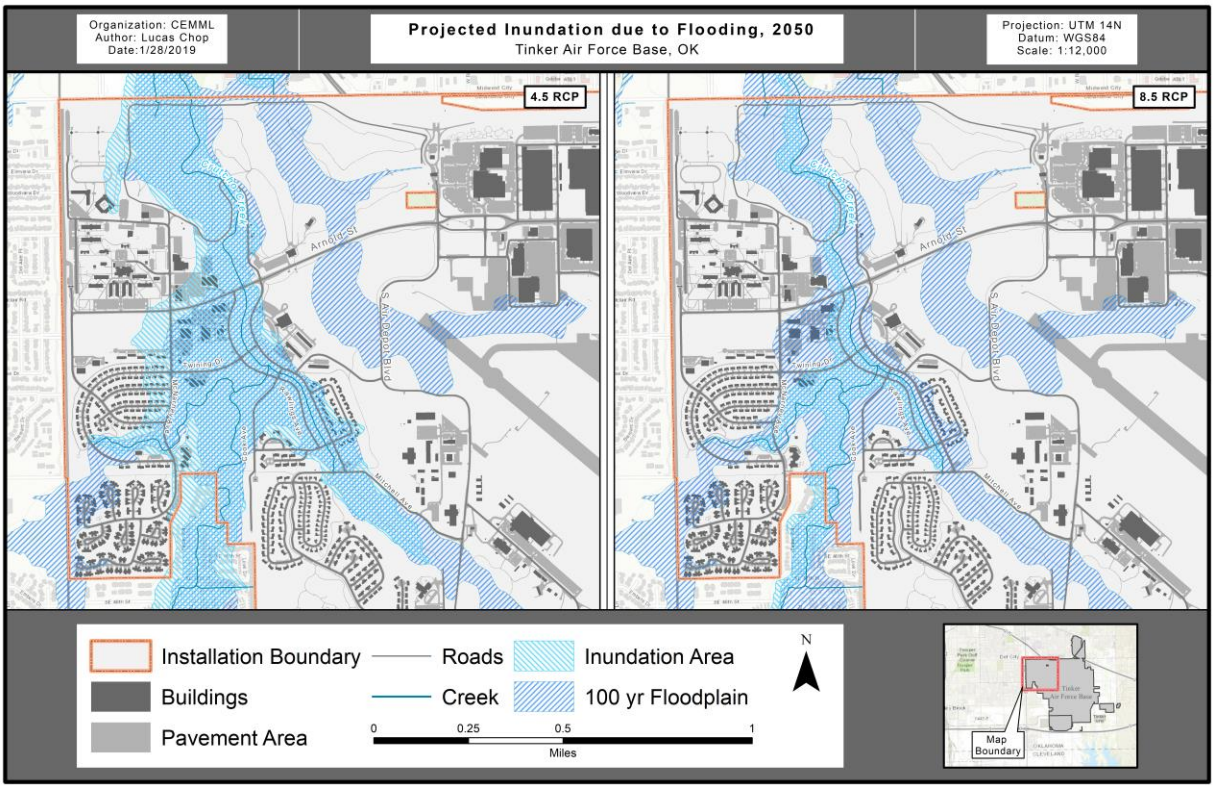

Figure C-4. Stream channel overflow for RCP 4.5 and RCP 8.5 emission scenarios in 2050.