



Department of Mechanical Engineering
ME 476C - 002

To: David Willy, Hussain Sodawalla

From: Trevor Senior, Evan Higgins, Riley Frisell

Team: Collegiate Hydropower Competition, F23toSp24_06

Date: December 1st, 2023

Re: Final CAD

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Francis Turbine casing 2
Francis Turbine assembly 3

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StreamDiver Casing 5
StreamDiver Runner Blade 6
StreamDiver assembly 7

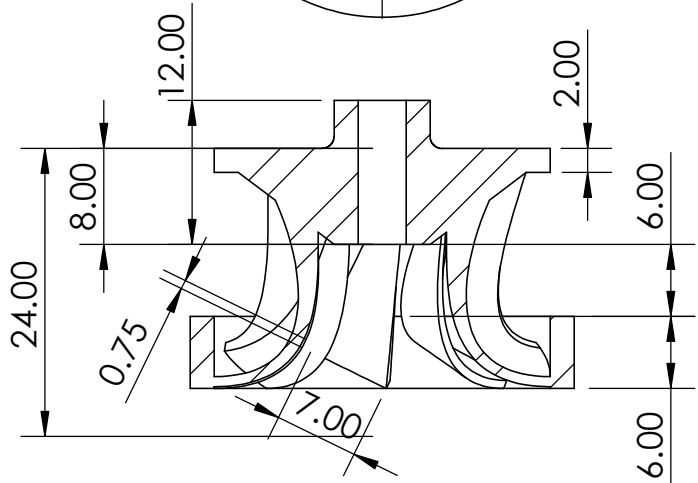
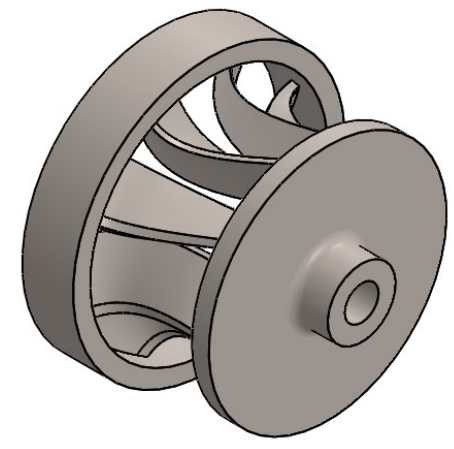
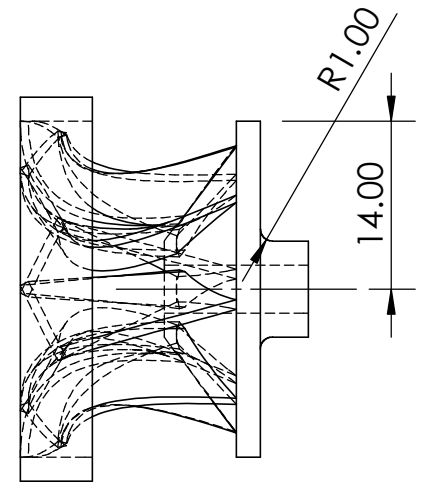
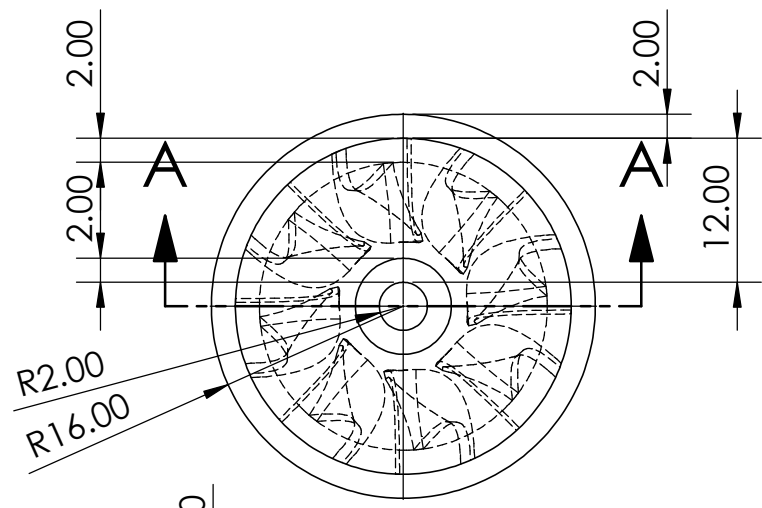
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1

B

B



SECTION A-A

A

A

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		ANGULAR: MACH ± BEND ±	MFG APPR.		
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		THREE PLACE DECIMAL ±	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		FINISH			
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

TITLE:		
SIZE	DWG. NO.	REV
A	Francis_Turbine	
SCALE: 1:16 WEIGHT:		SHEET 1 OF 1

1

1

B

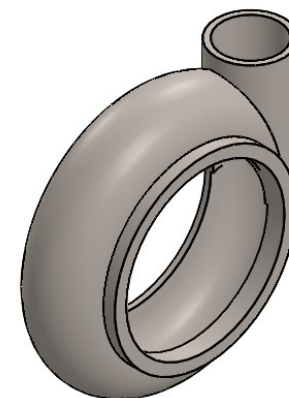
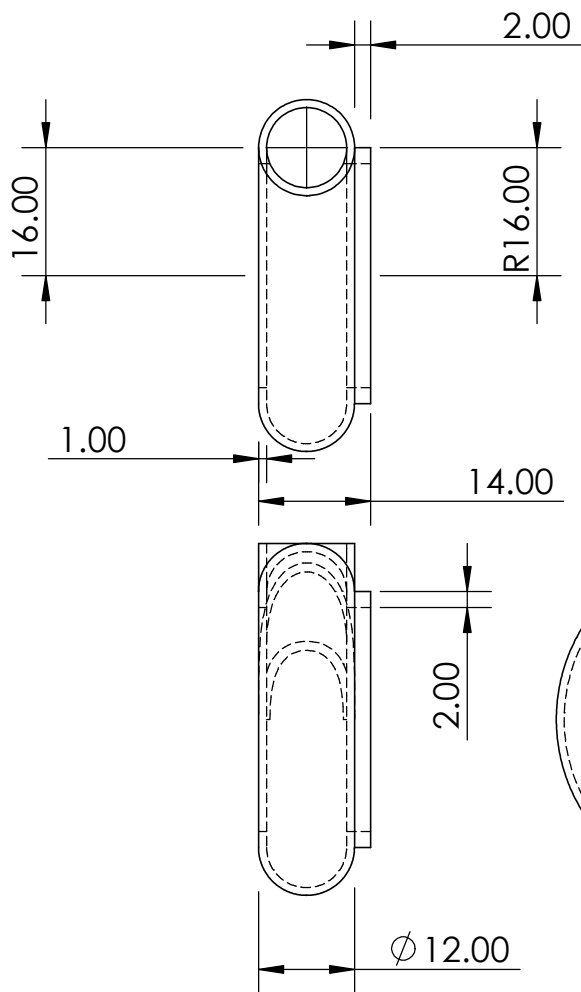
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		TWO PLACE DECIMAL \pm		Q.A.					
		THREE PLACE DECIMAL \pm		COMMENTS:					
		INTERPRET GEOMETRIC TOLERANCING PER:				SIZE	DWG. NO.	REV	
		MATERIAL				A	Turbine_Shell		
NEXT ASSY	USED ON	FINISH				SCALE: 1:24		WEIGHT:	SHEET 1 OF 1
APPLICATION		DO NOT SCALE DRAWING							

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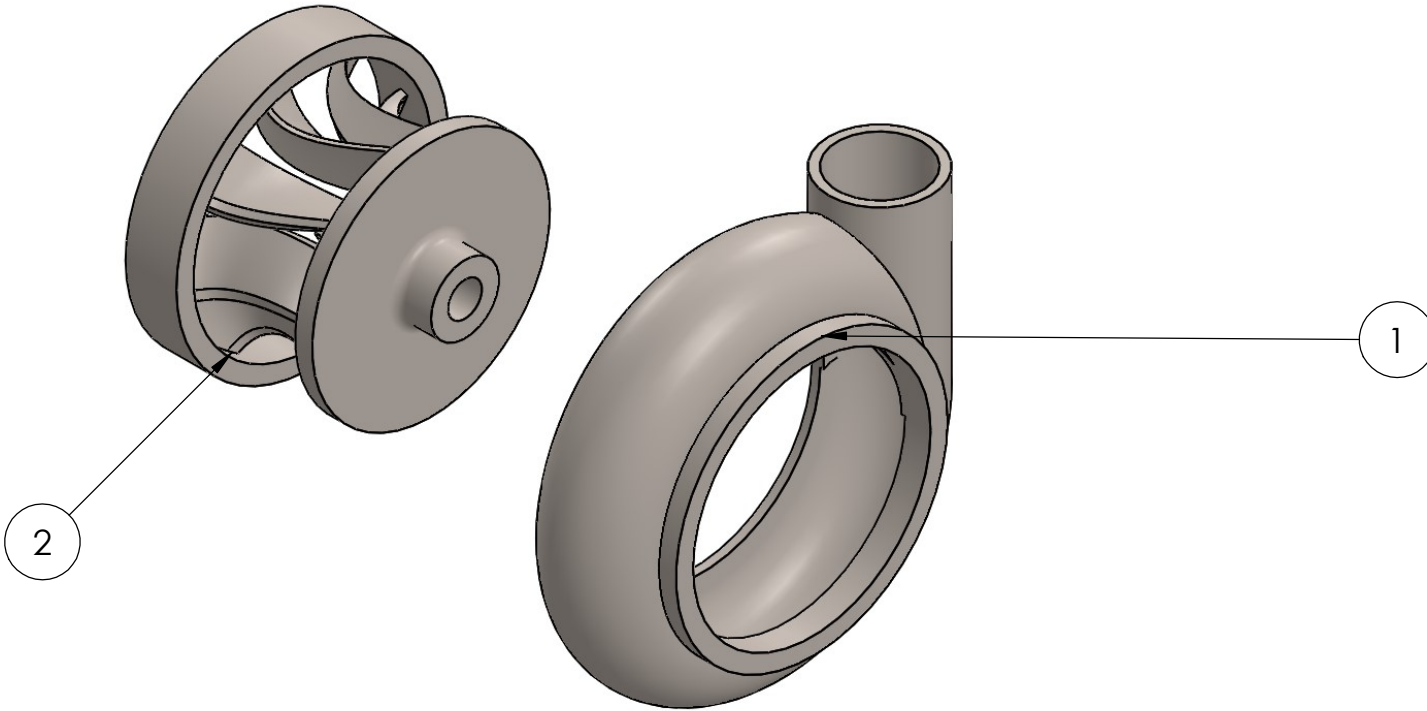
2

1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Turbine_Shell	Guide water past turbine	1
2	Francis_Turbine	Capture KE from water	1

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		THREE PLACE DECIMAL ±	COMMENTS:					
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		MATERIAL						
NEXT ASSY	USED ON	FINISH						
APPLICATION		DO NOT SCALE DRAWING						

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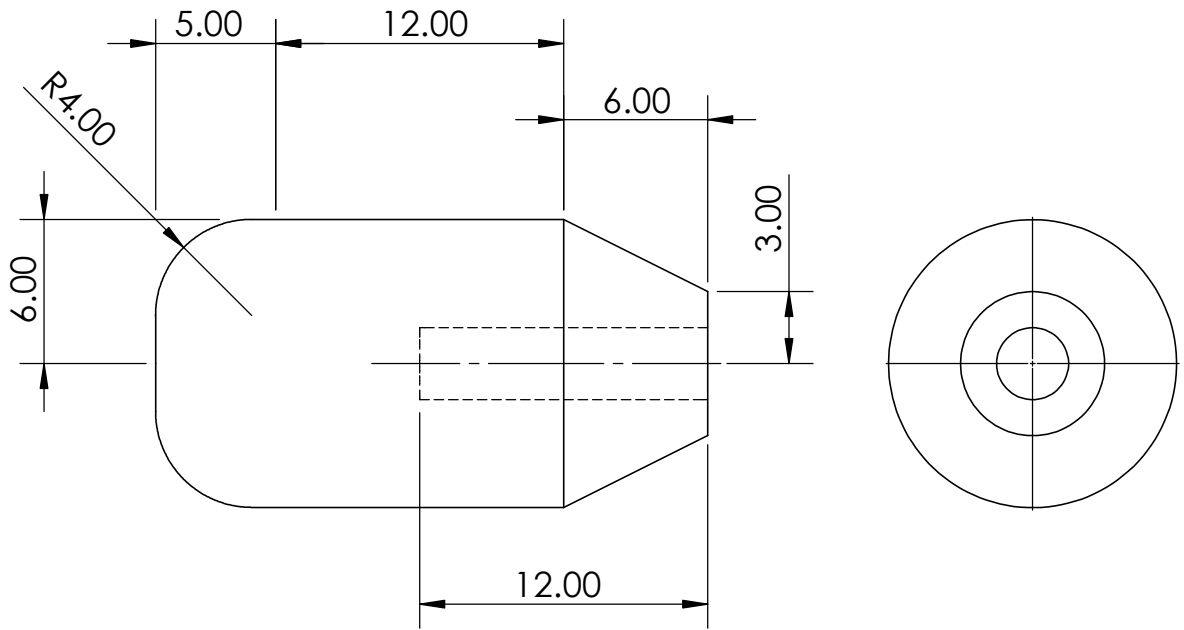
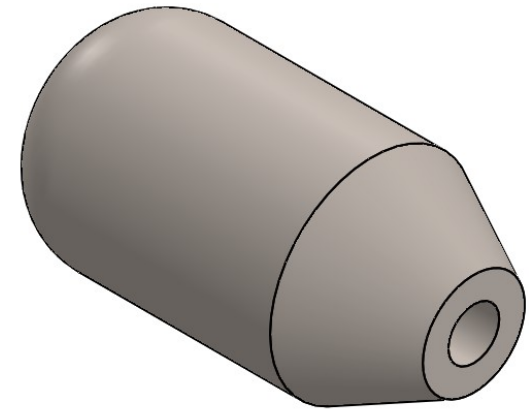
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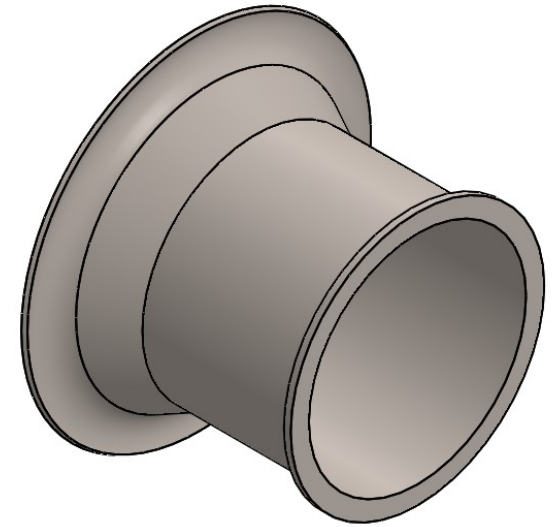
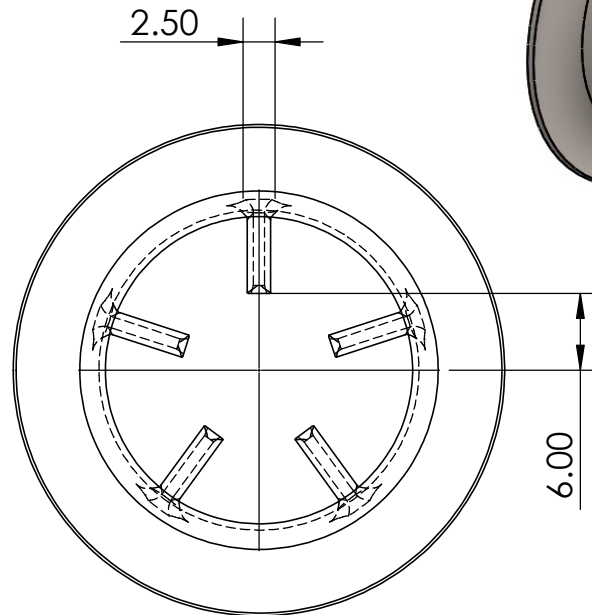
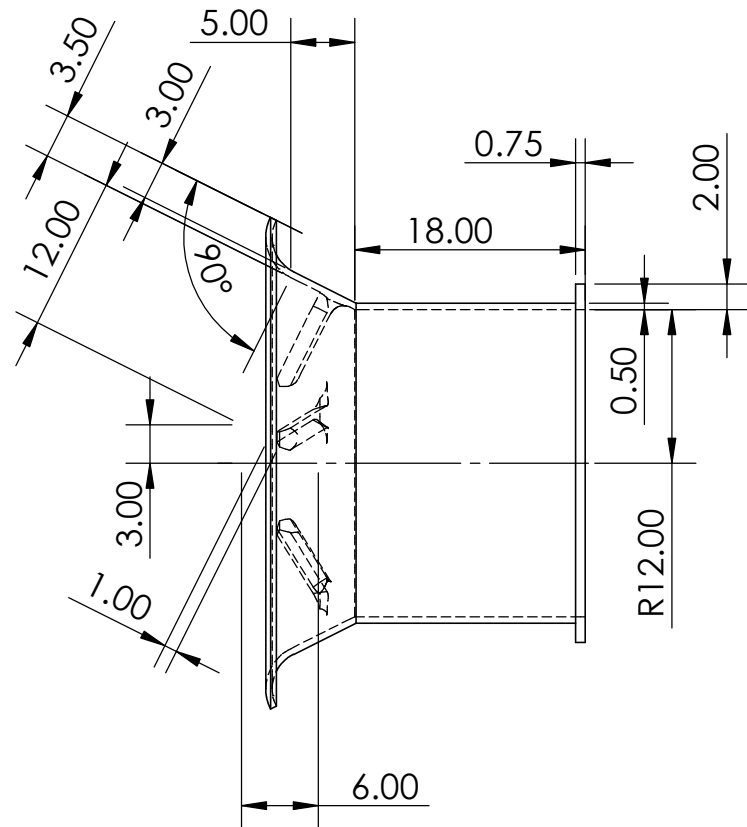
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		THREE PLACE DECIMAL ±	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		Stainless steel			
		FINISH			
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

TITLE:
Permanent magnet generator
 permanent magnet generator
 SCALE: 1:8 WEIGHT: SHEET 1 OF 1

1

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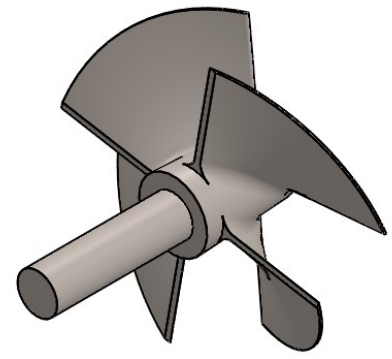
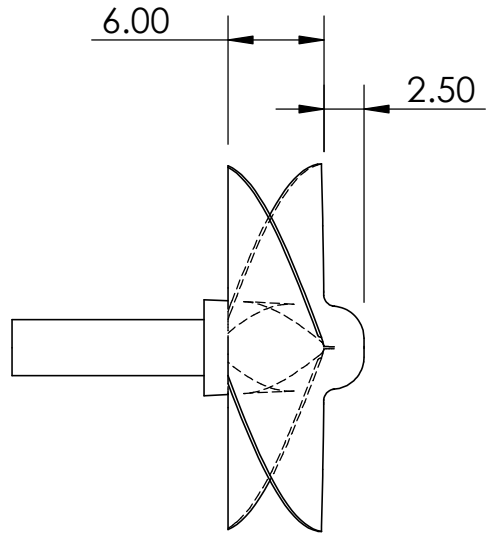
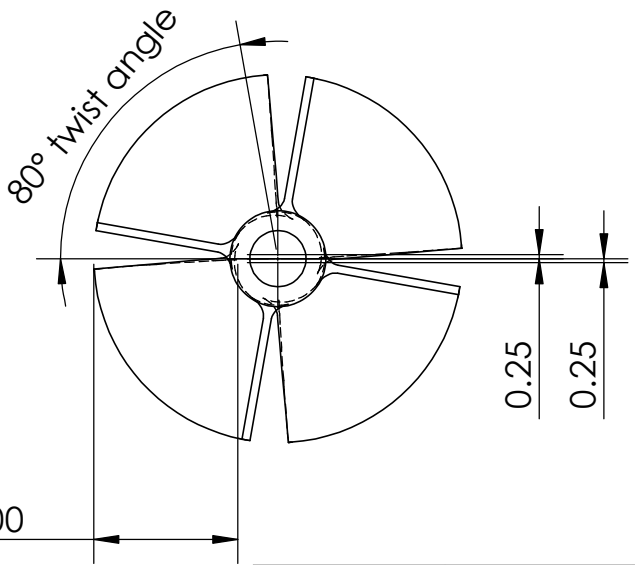
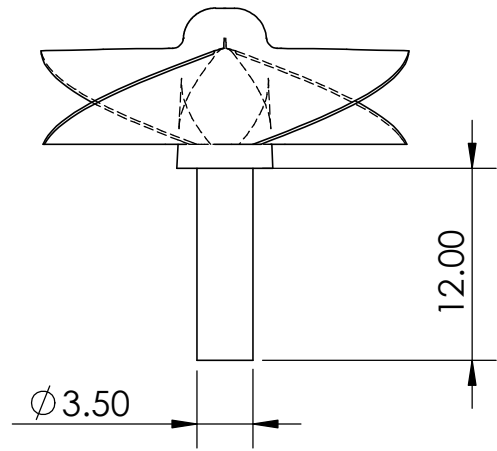
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		UNLESS OTHERWISE SPECIFIED:		NAME	DATE	TITLE: Turbine housing		
		DIMENSIONS ARE IN INCHES	DRAWN	TS				
		TOLERANCES: FRACTIONAL ±	CHECKED					
		ANGULAR: MACH ± BEND ±	ENG APPR.					
		TWO PLACE DECIMAL ±	MFG APPR.					
		THREE PLACE DECIMAL ±	Q.A.			SIZE	DWG. NO.	REV
		INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:			A	3	
		MATERIAL						
		Stainless Steel						
		FINISH						
	NEXT ASSY	USED ON						
	APPLICATION		DO NOT SCALE DRAWING					
						SCALE: 1:24	WEIGHT:	SHEET 1 OF 1

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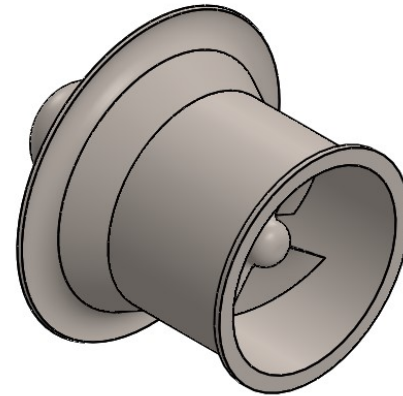
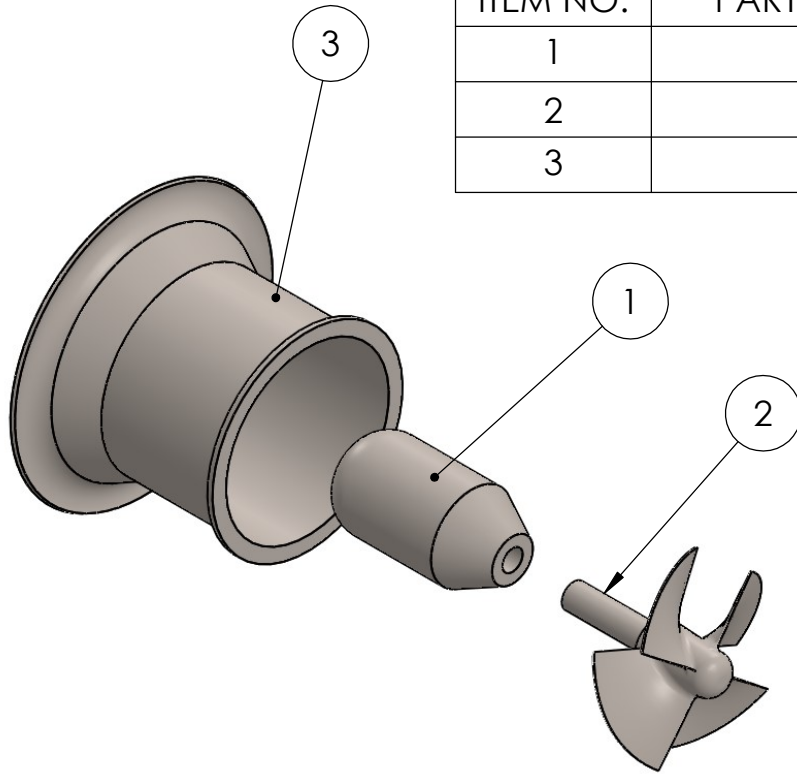
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		THREE PLACE DECIMAL \pm	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		Stainless Steel			
		FINISH			
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

TITLE:		
Runner fixed blades		
SIZE	DWG. NO.	REV
A	2	
SCALE: 1:12		WEIGHT:
		SHEET 1 OF 1

2

1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	1	permanent magnet generator	1
2	2	turbine runner with fixed blades	1
3	3	turbine housing to guide water	1



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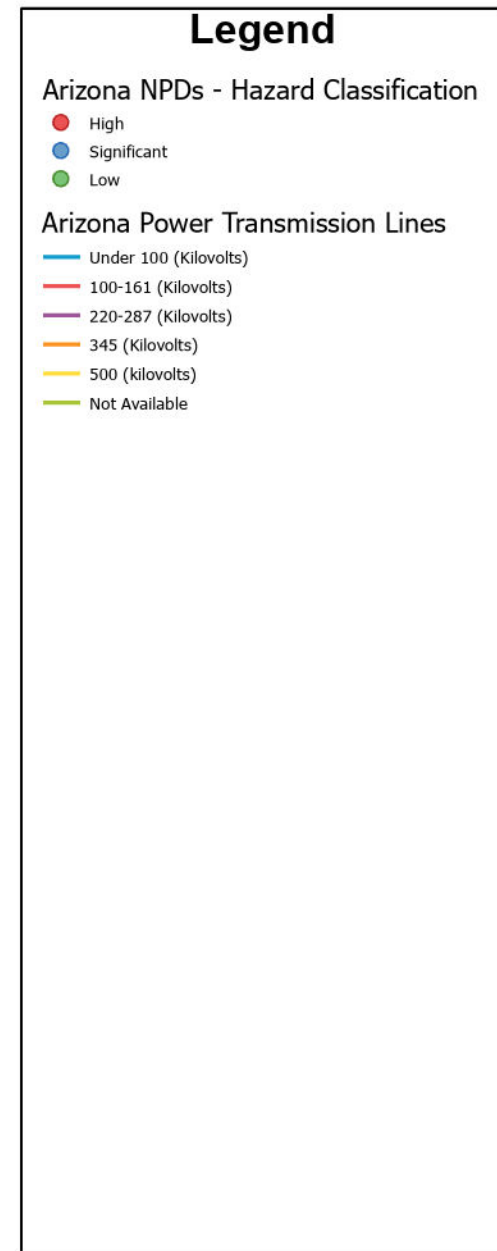
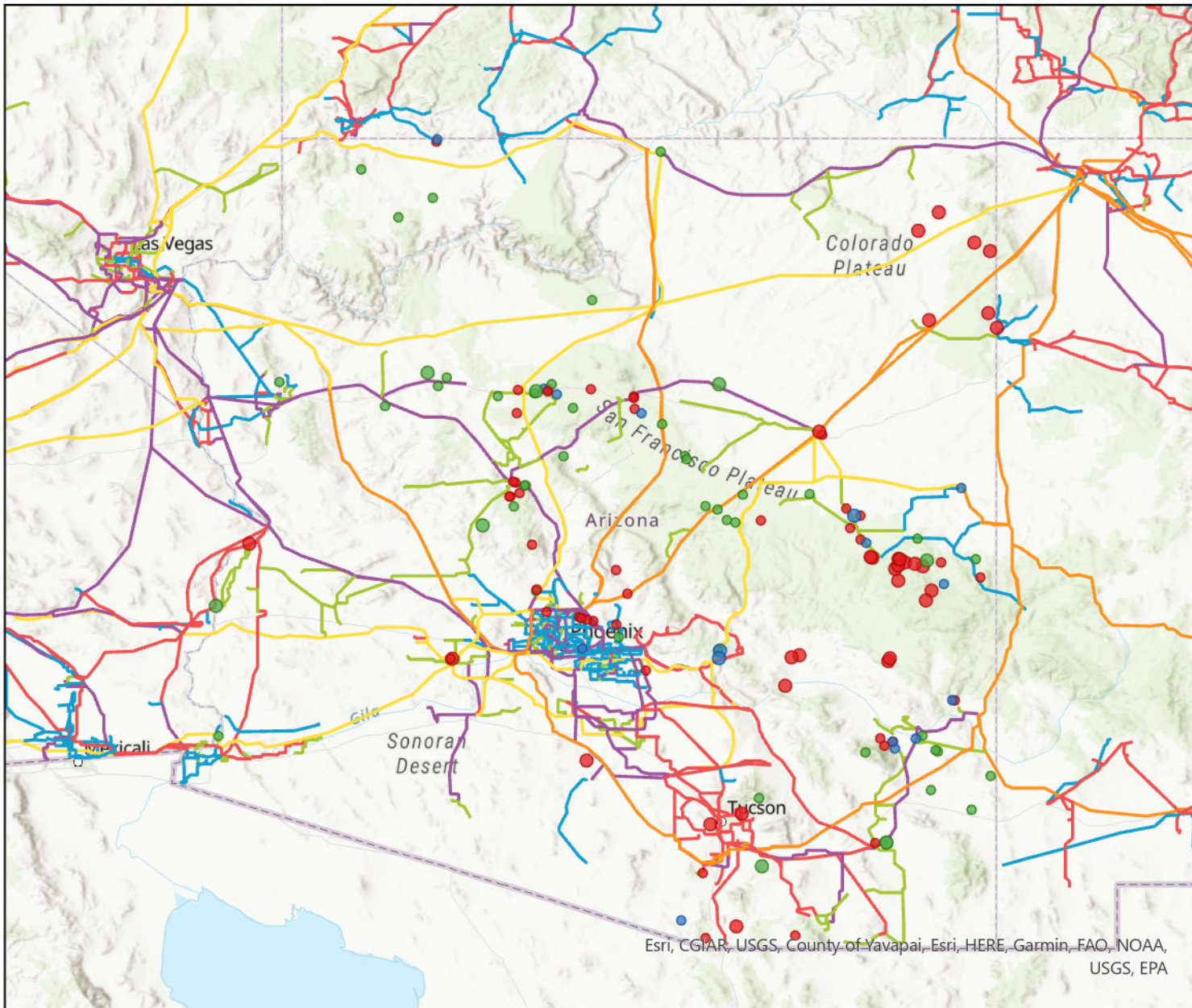
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		TWO PLACE DECIMAL ±	Q.A.		
		THREE PLACE DECIMAL ±	COMMENTS:		
		INTERPRET GEOMETRIC TOLERANCING PER:			
		MATERIAL			
		Stainless Steel			
		FINISH			
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

TITLE:		
Prototype Hydroturbine		
SIZE	DWG. NO.	REV
A	model assem.	
SCALE: 1:20	WEIGHT:	SHEET 1 OF 1

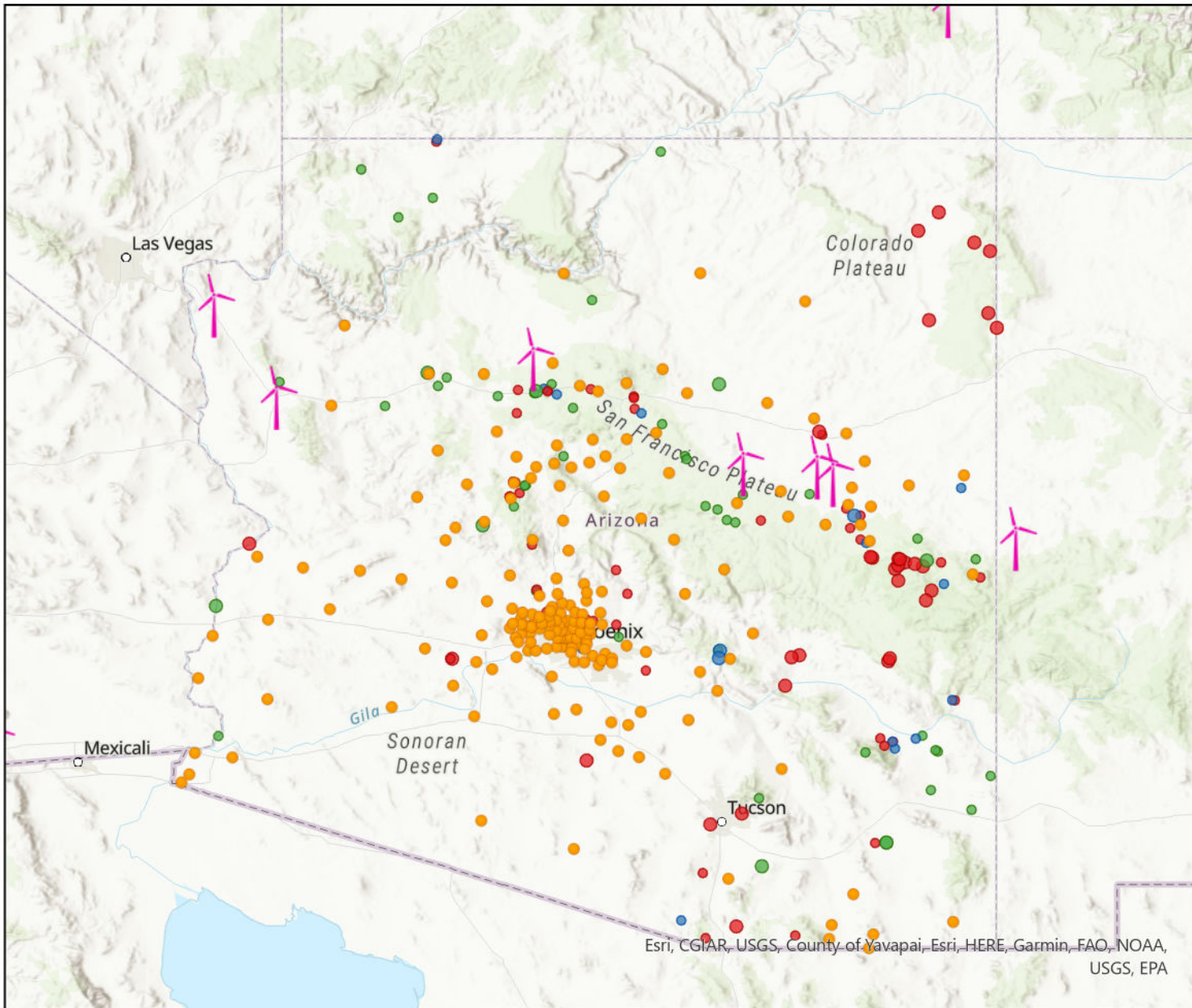
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7



Assessment of Non-Powered Dams in Arizona






Arizona NPDs: Co-Development Opportunities



Legend

-  Wind Power Plants
-  Arizona Solar Installations

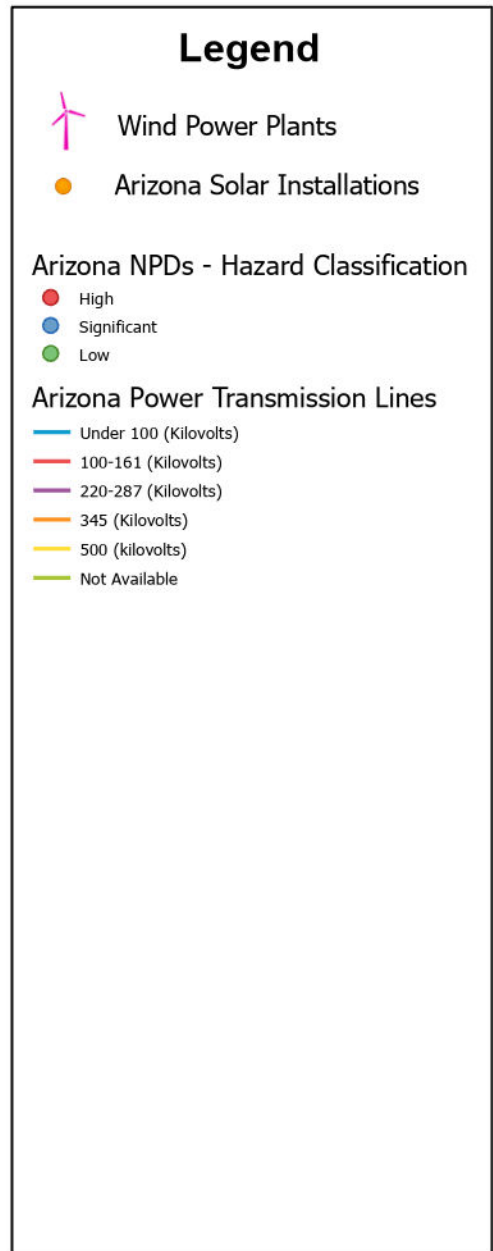
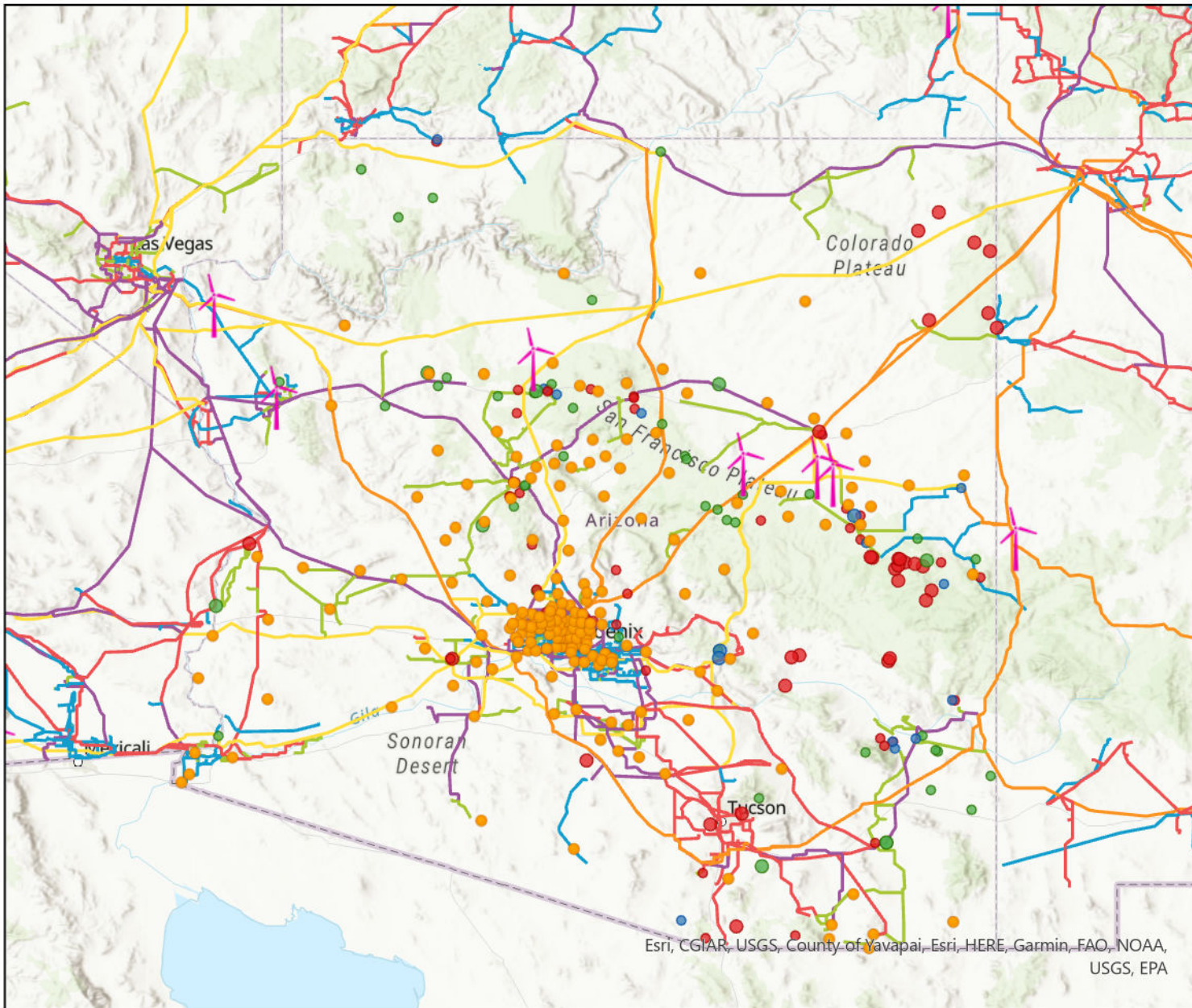
Arizona NPDs - Hazard Classification

-  High
-  Significant
-  Low

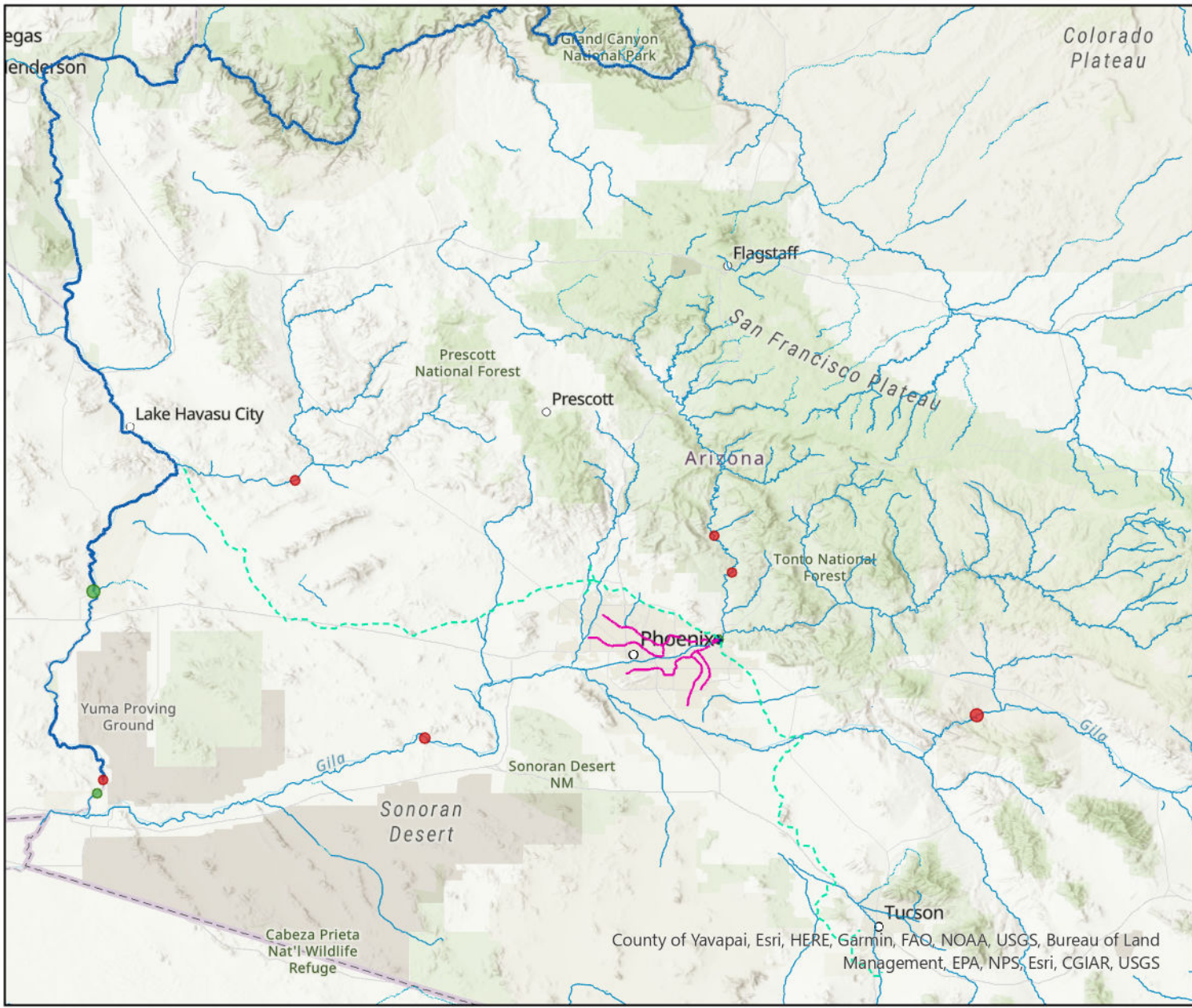
Esri, CGIAR, USGS, County of Yavapai, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA



Arizona NPDs: Co-Development Opportunities



Final Selection of Arizona Non-Powered Dams



Legend

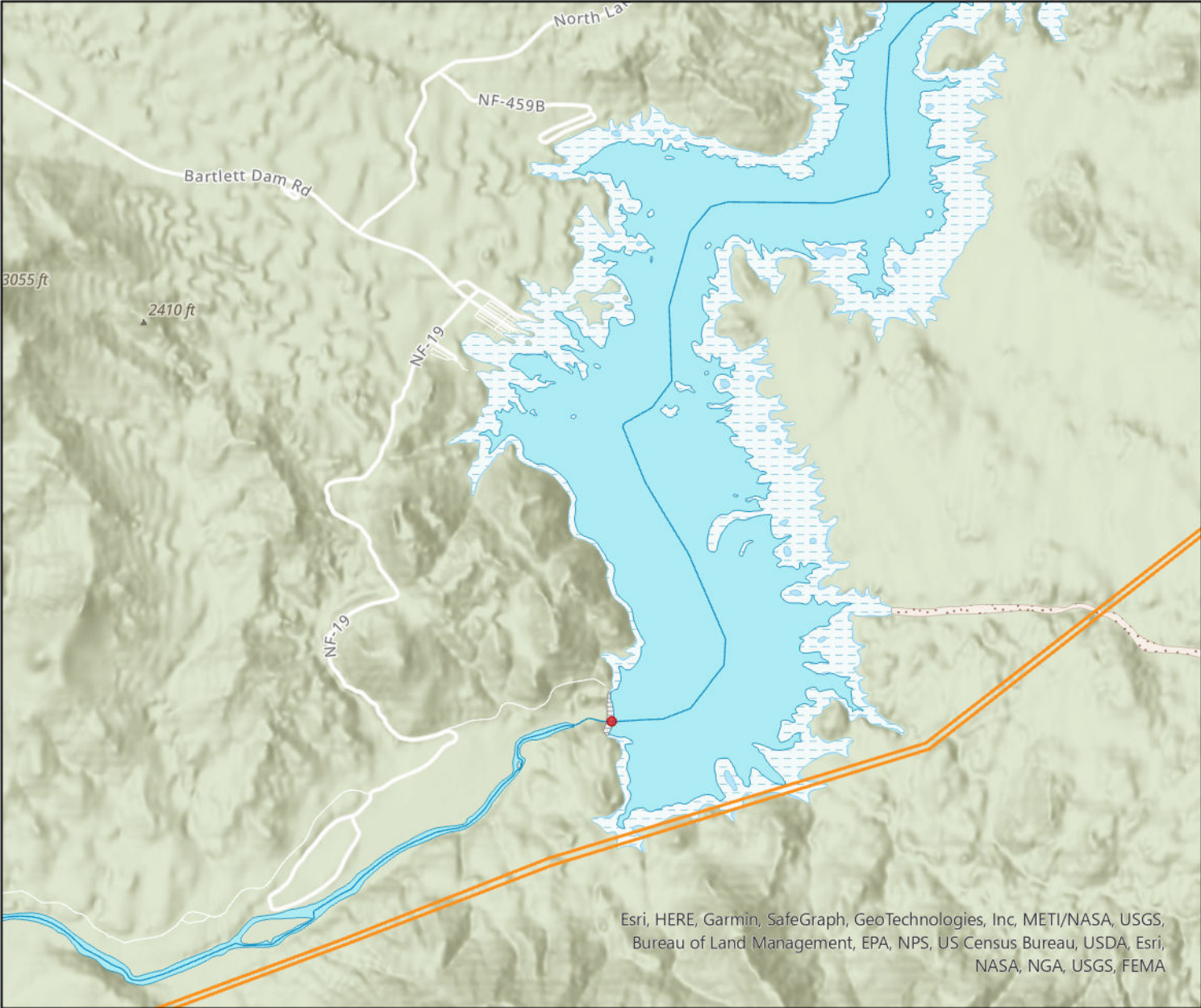
- - - SRP Canals
- - - CAP Canal
- High Hazard Classification Dams
- Low Hazard Classification Dams
- Streamline: 10,000 - 100,000 cfs
- Streamline: 5,000 - 10,000 cfs
- Streamline: 0 - 5,000 cfs
- · - · - Streamline: Ephemeral/ Intermittent
- Streamline: Pipeline

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Hydropower Collegiate Competition
 F23toSP24_06
 Riley Frisell, Evan Higgins, and Trevor Senior

Bartlett Lake Dam - Topographic Map

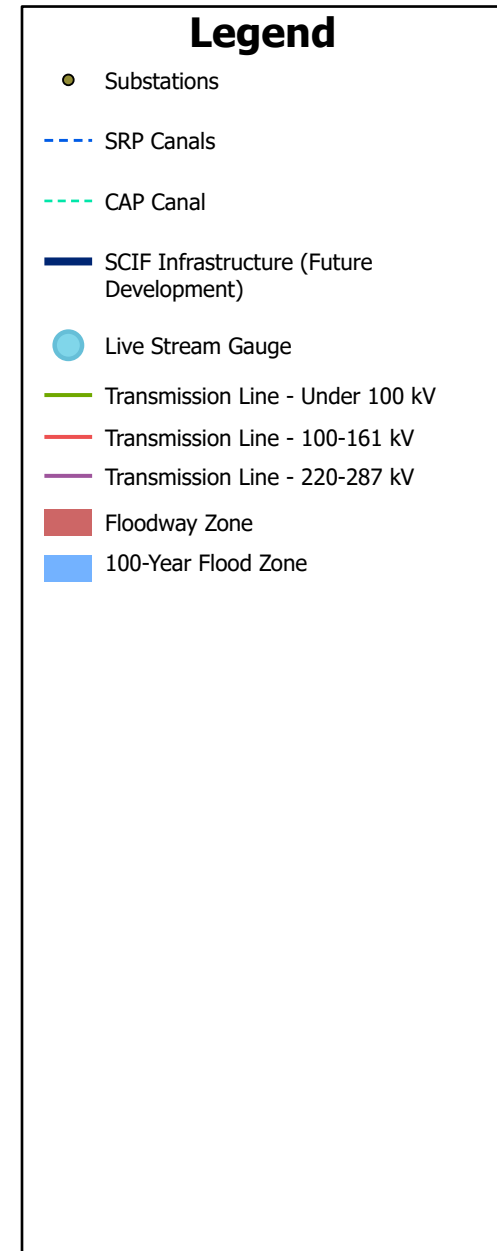
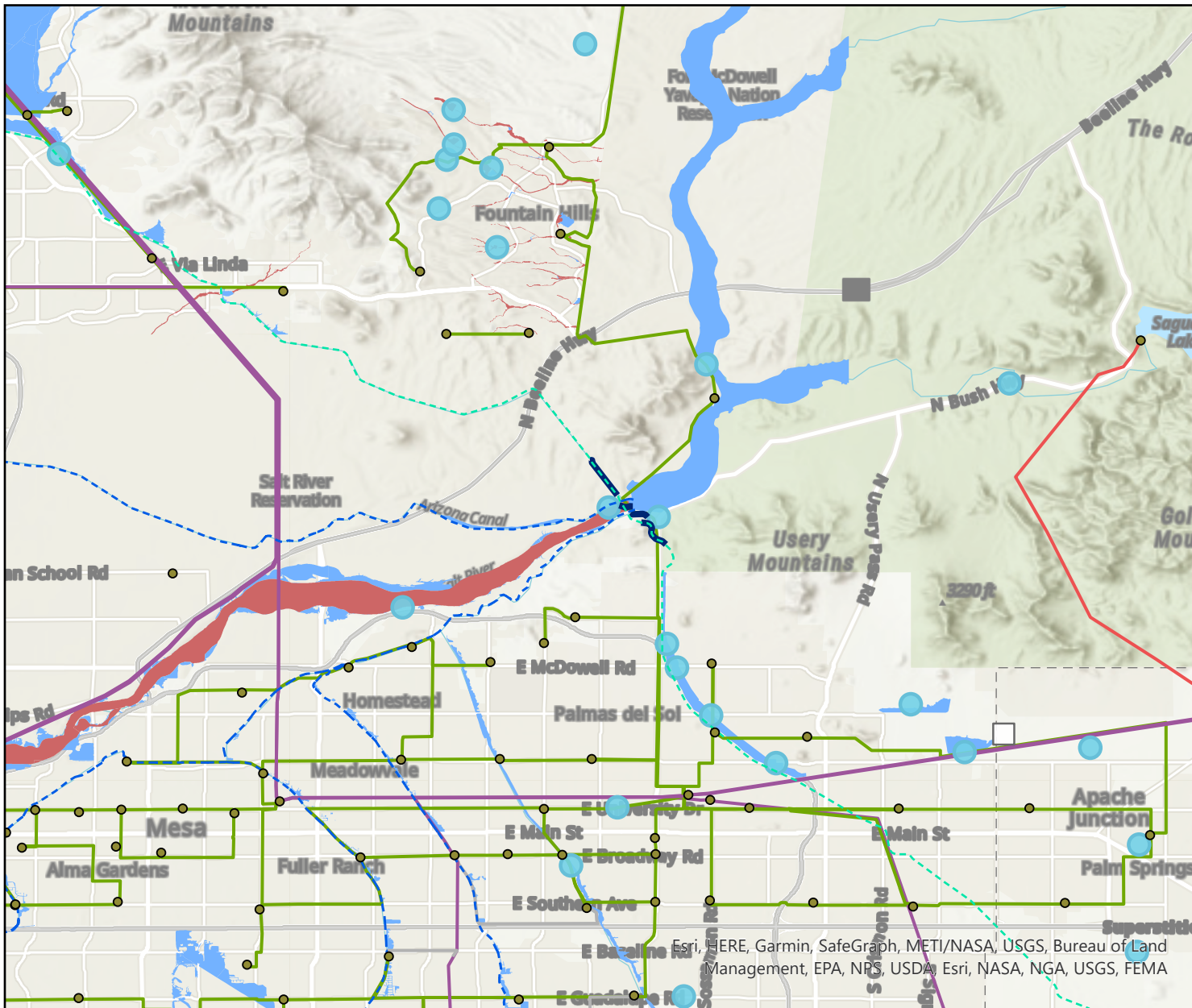


Legend

- Bartlett Lake Dam - High Hazard Classification
- Transmission Line - 345 kV
- Streamline - 0-2000 cfs
- Areas Subject to Flooding
- Bartlett Lake Dam Structure
- Playa or Wash
- Bartlett Lake/Verde River

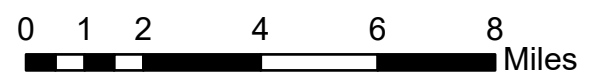


East Mesa/Apache Junction Topographic Map



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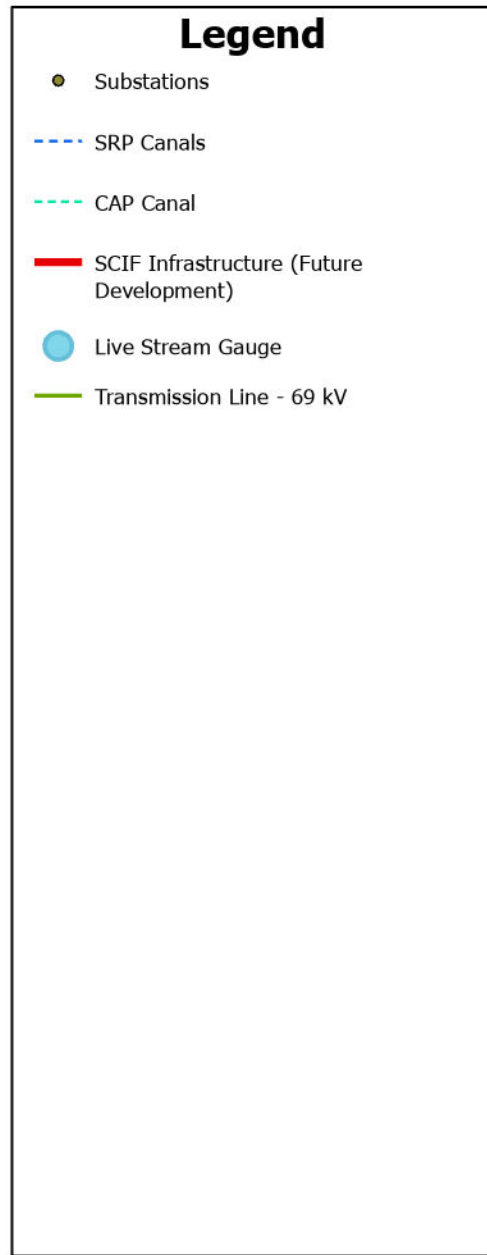
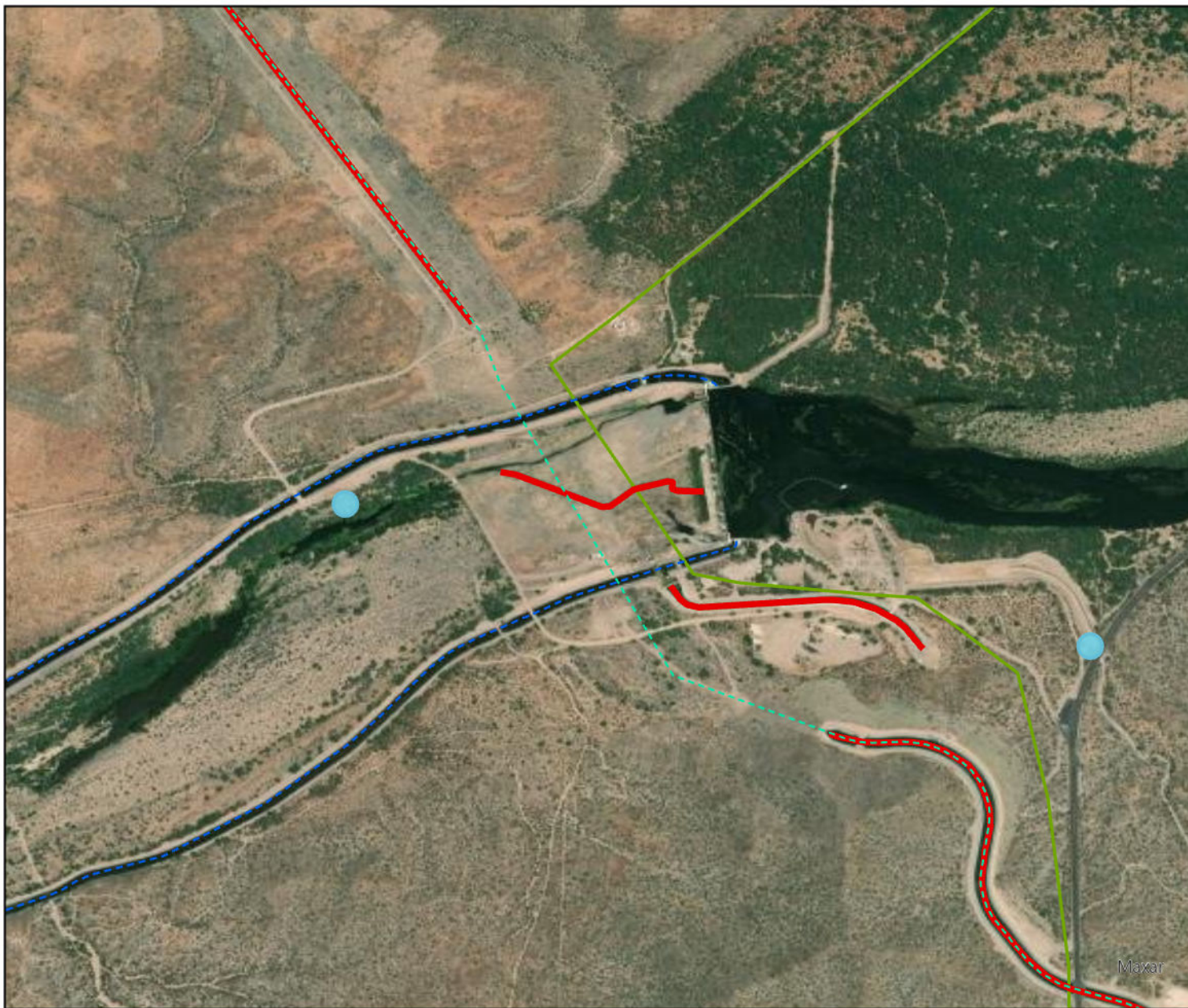
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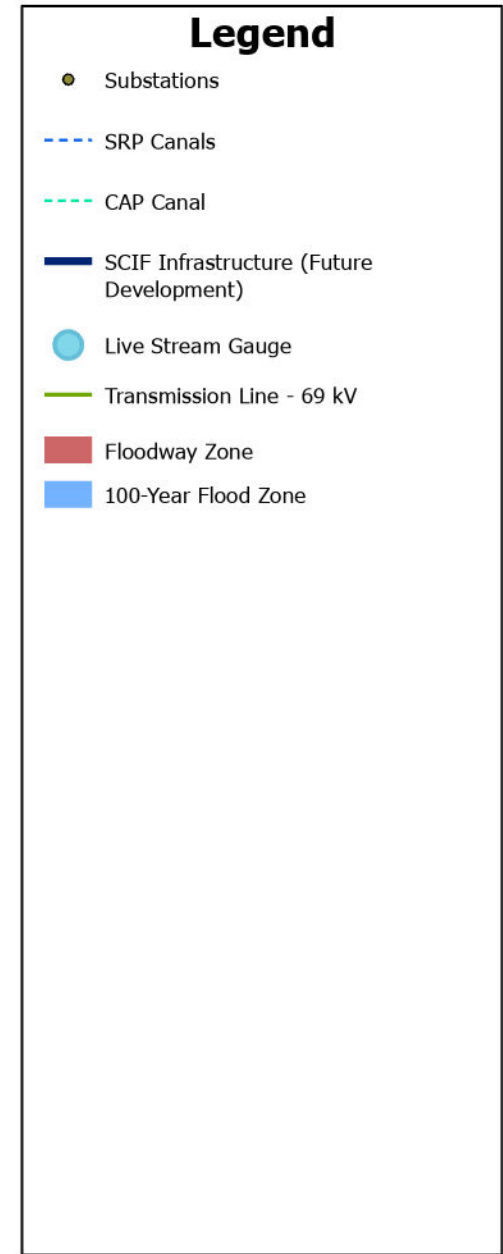
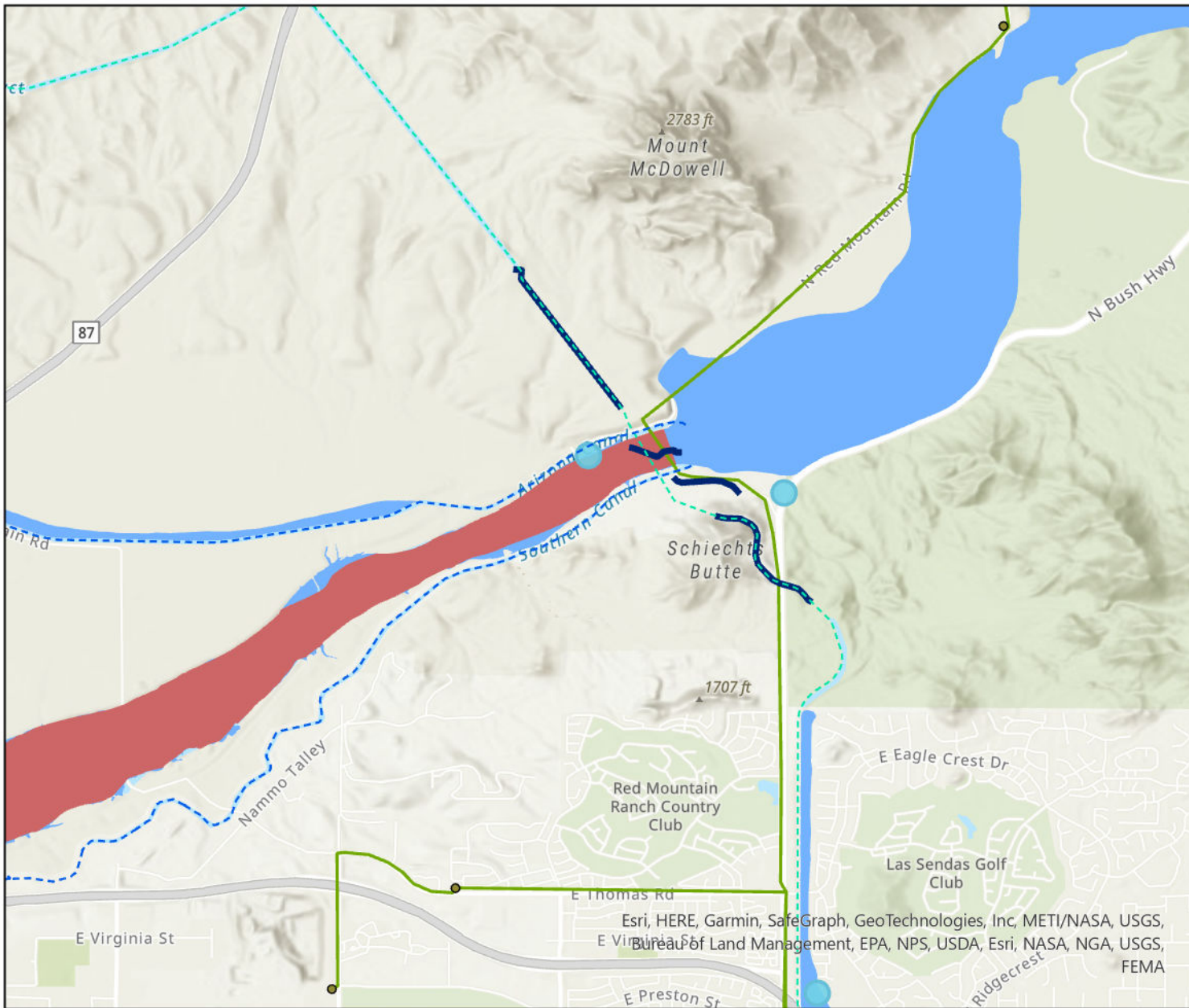
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Esri, NASA, NGA, USGS, FEMA

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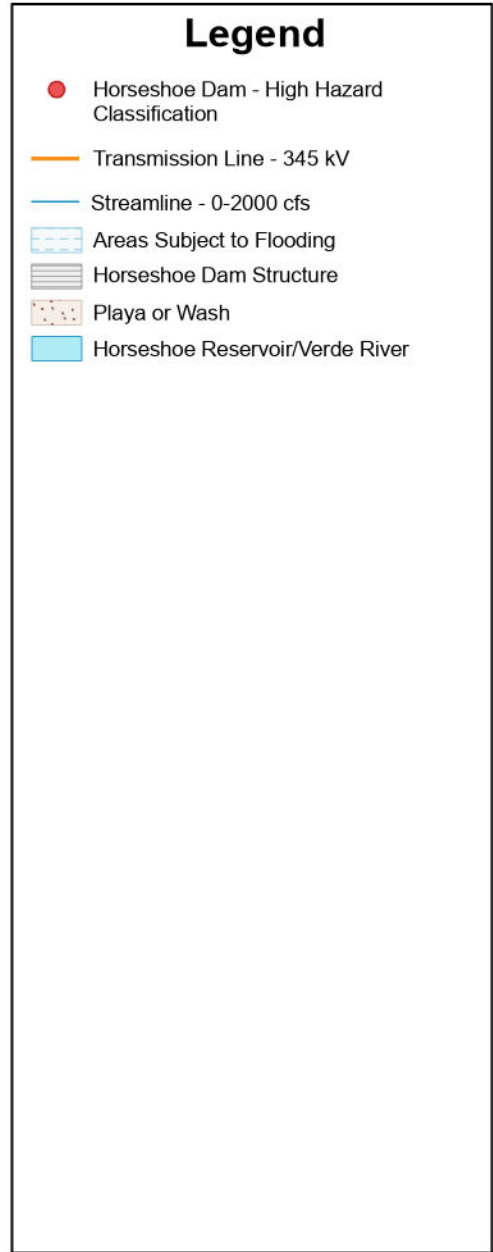
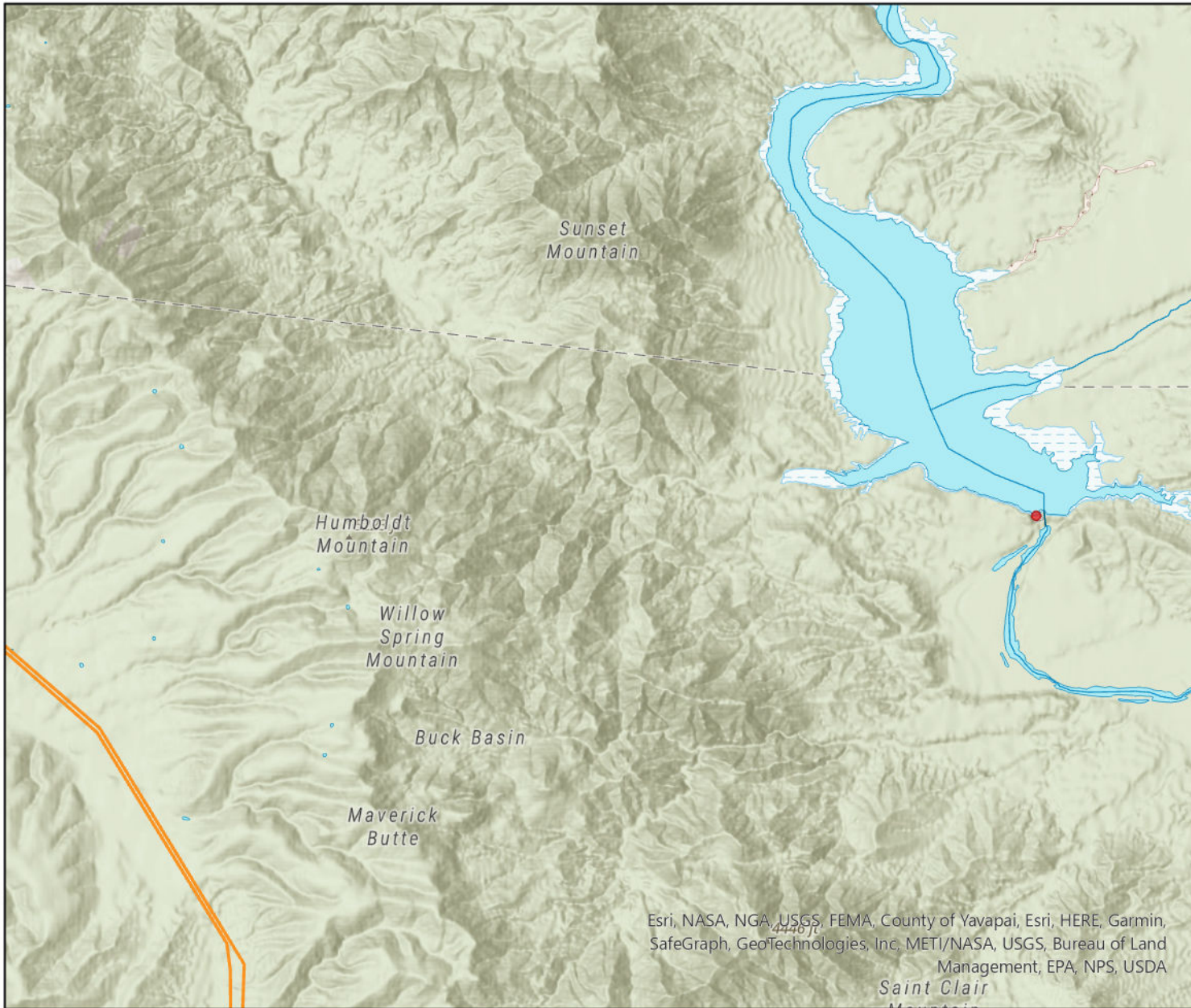
Granite Reef Diversion Dam - Site Map



Granite Reef Diversion Dam - Site Topographic Map



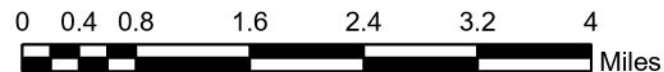
Horseshoe Dam - Topographic Map



Esri, NASA, NGA, USGS, FEMA, County of Yavapai, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

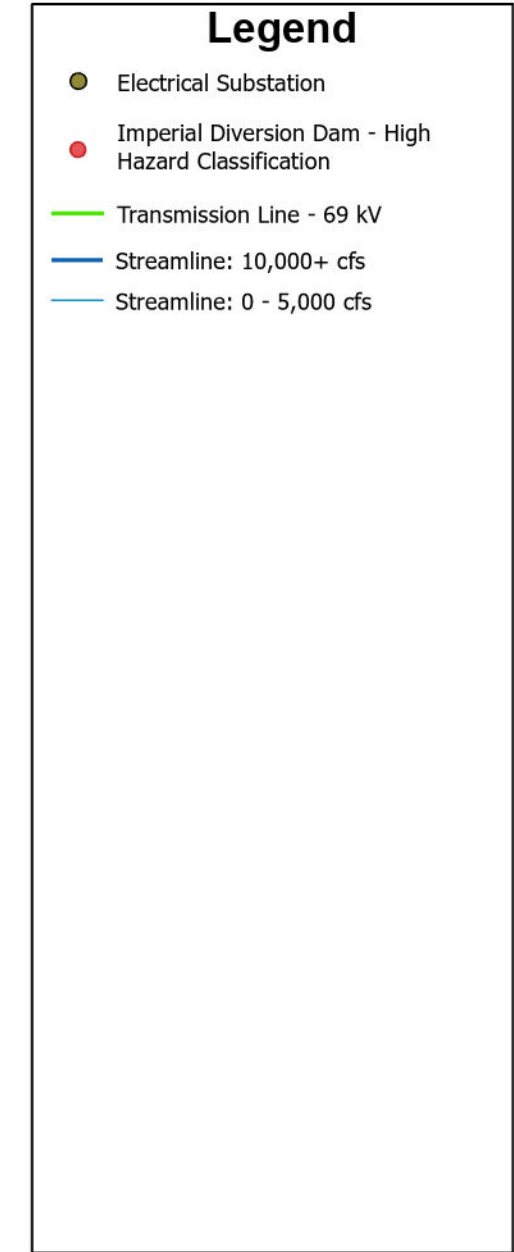
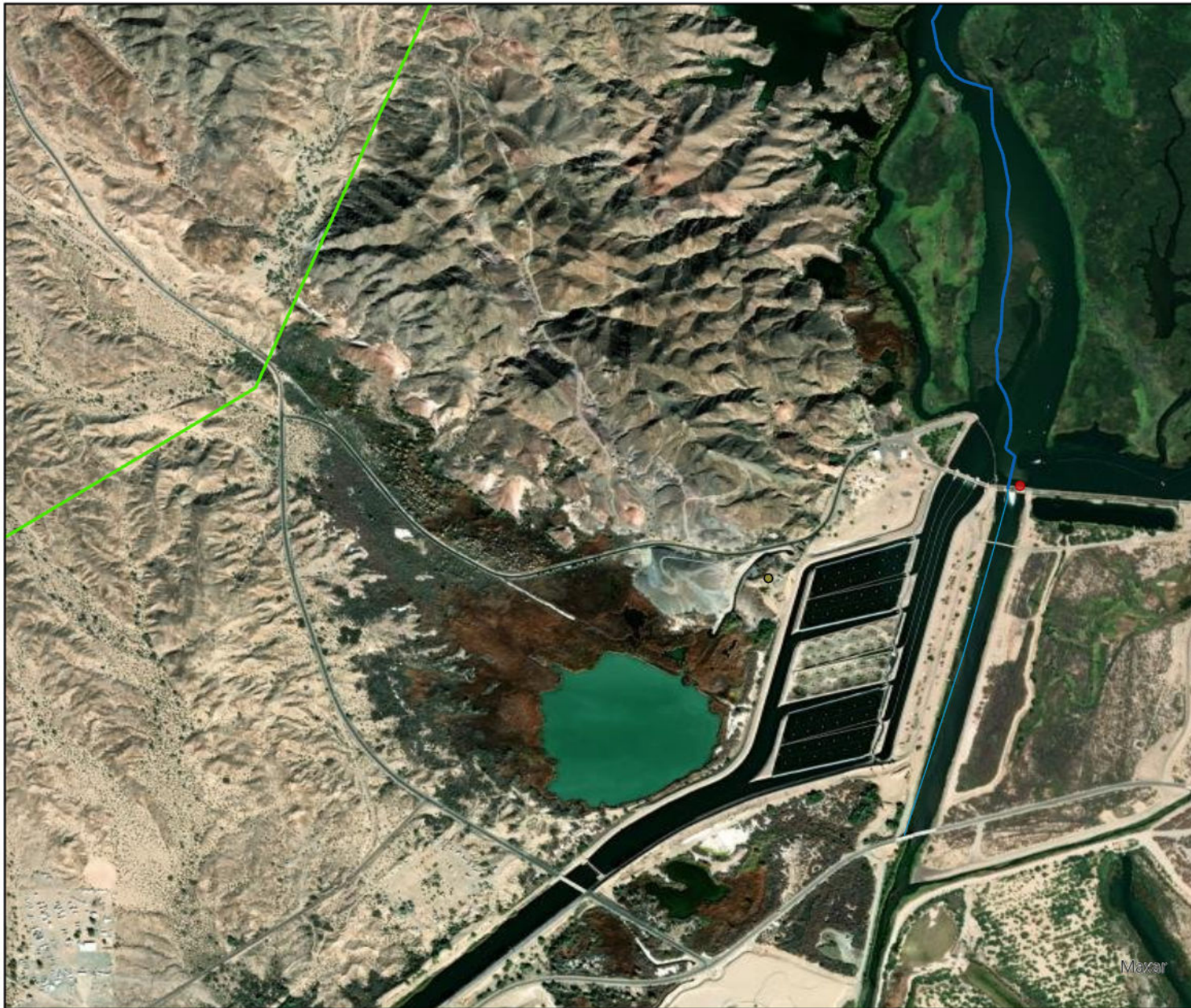
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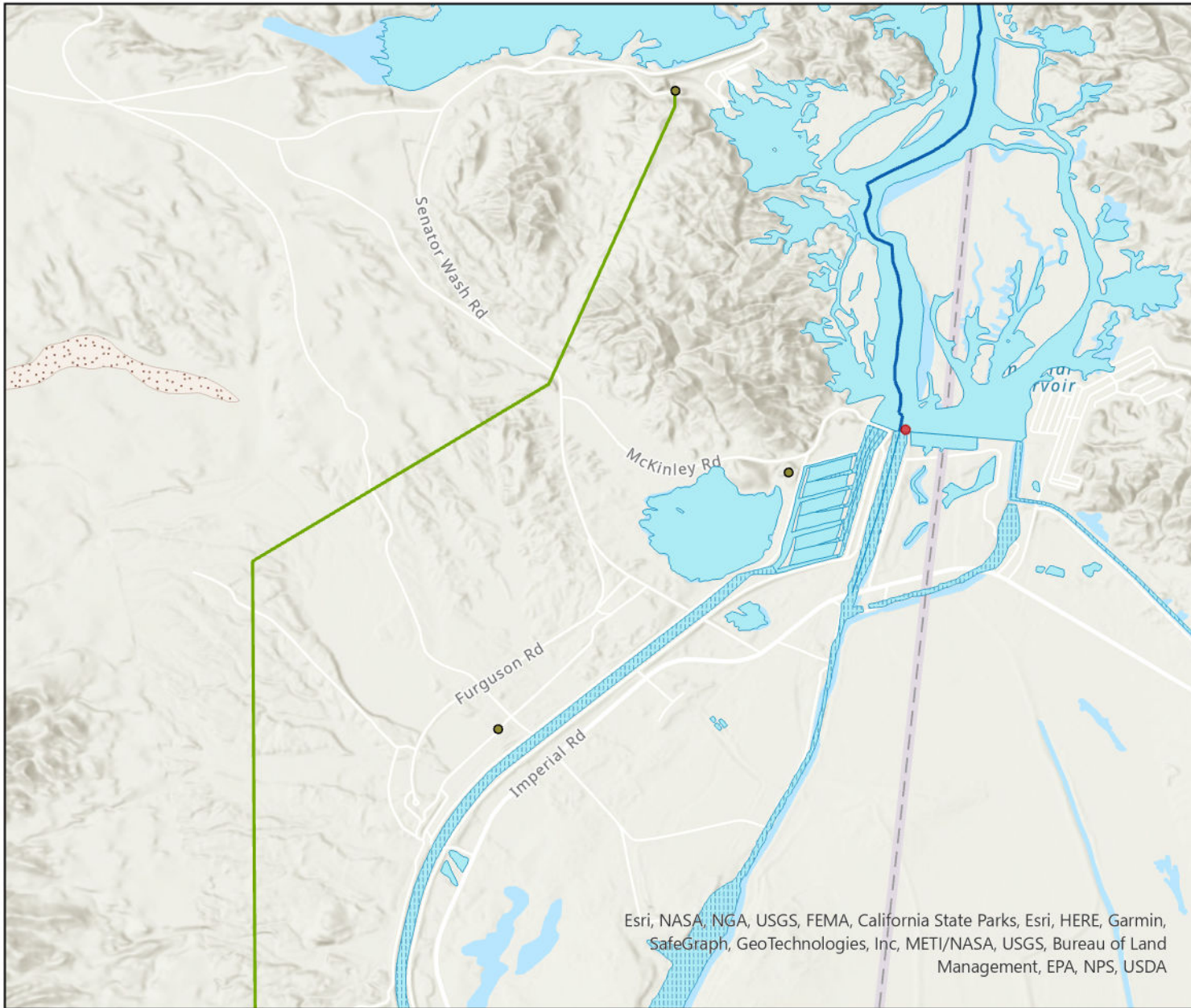


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Imperial Diversion Dam - Site Aerial Map



Imperial Diversion Dam - Topographic Map

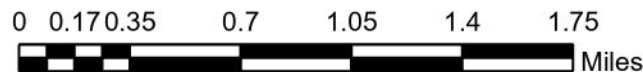


Esri, NASA, NGA, USGS, FEMA, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

Legend

- Electrical Substation
- Imperial Diversion Dam - High Hazard Classification
- Transmission Line - 69 kV
- Streamline: 10,000+ cfs
- Streamline: 0 - 5,000 cfs
- Aqueduct
- Playa or Wash
- Colorado River, Imperial Reservoir, and Other Water Bodies

Hydropower Collegiate Competition
F23toSP24_06
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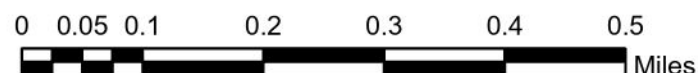


Palo Verde Diversion Dam - Site Aerial Map

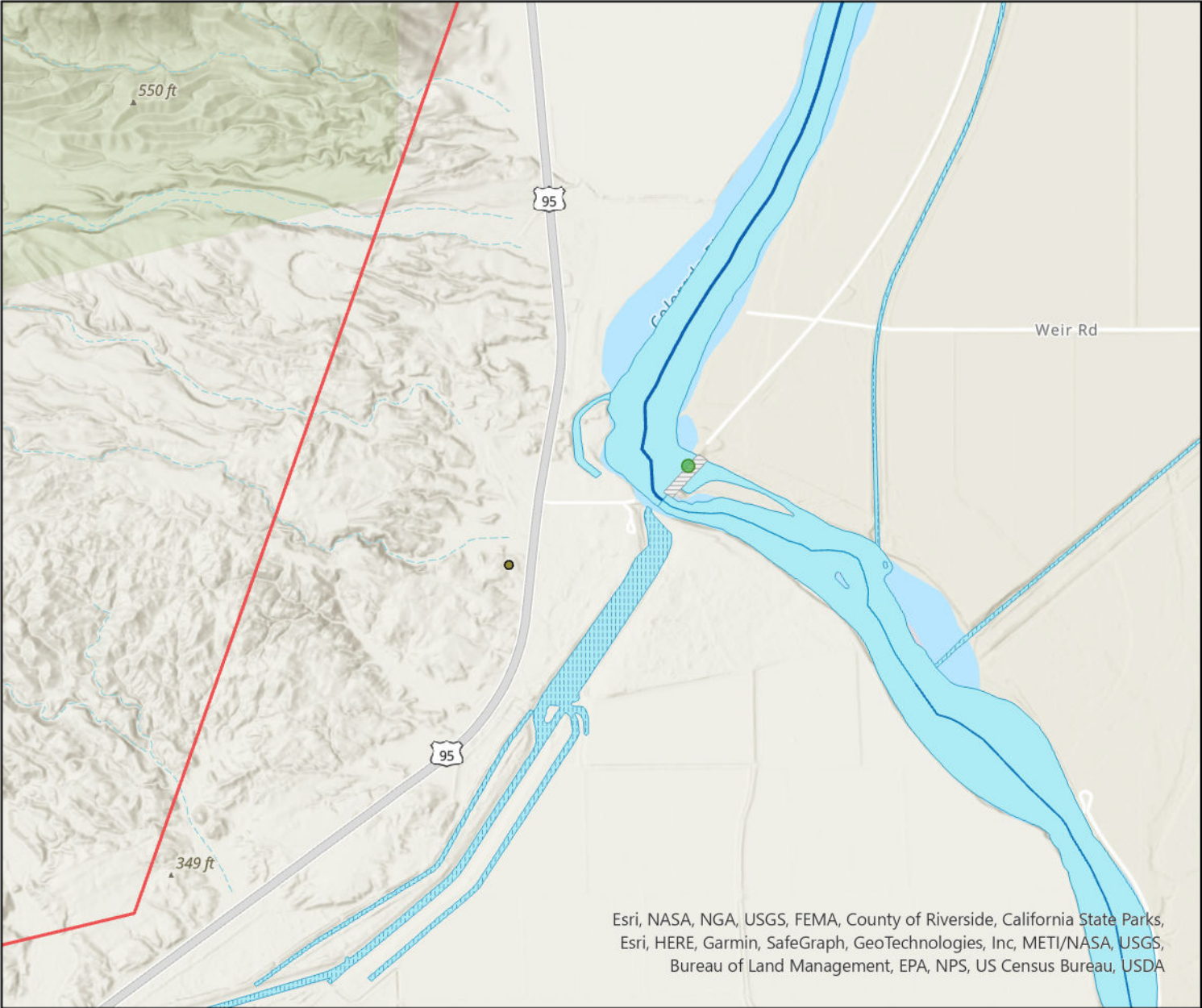


Legend

- Electrical Substation
- Imperial Diversion Dam - Low Hazard Classification
- Transmission Line - 161 kV
- Streamline: 10,000+ cfs
- Streamline: 0 - 5,000 cfs



Palo Verde Diversion Dam - Topographic Map



Legend

- Electrical Substation
- Imperial Diversion Dam - Low Hazard Classification
- Transmission Line - 161 kV
- Streamline: 10,000+ cfs
- Streamline: 0 - 5,000 cfs
- Aqueduct
- Palo Verde Diversion Dam
- Colorado River

Esri, NASA, NGA, USGS, FEMA, County of Riverside, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA

