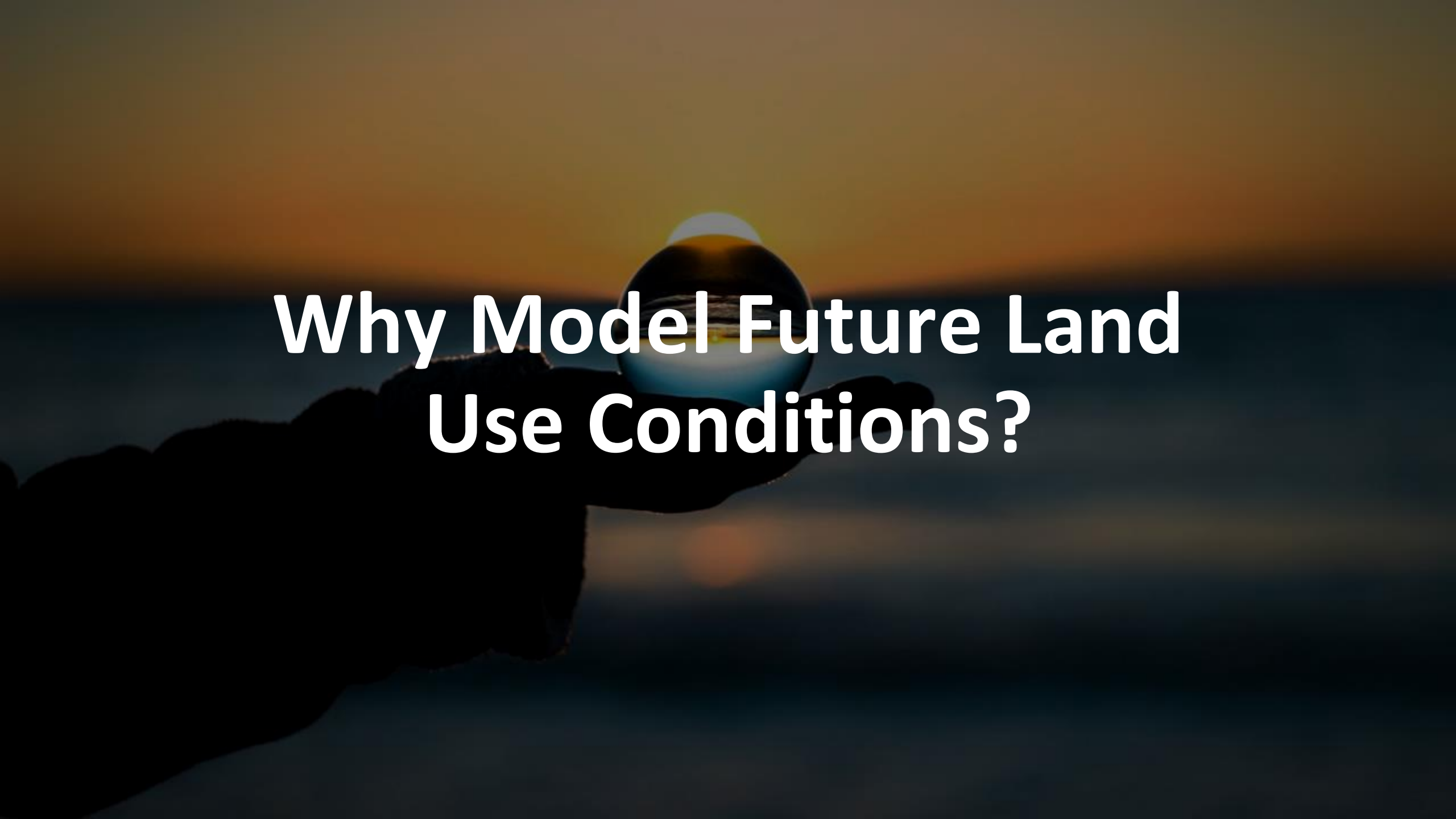


Phase 7 2040 Land Use “Business-As-Usual” Scenario

**Modeling the Effects of Population, Employment, and
Renewable Energy on Land Use Change**

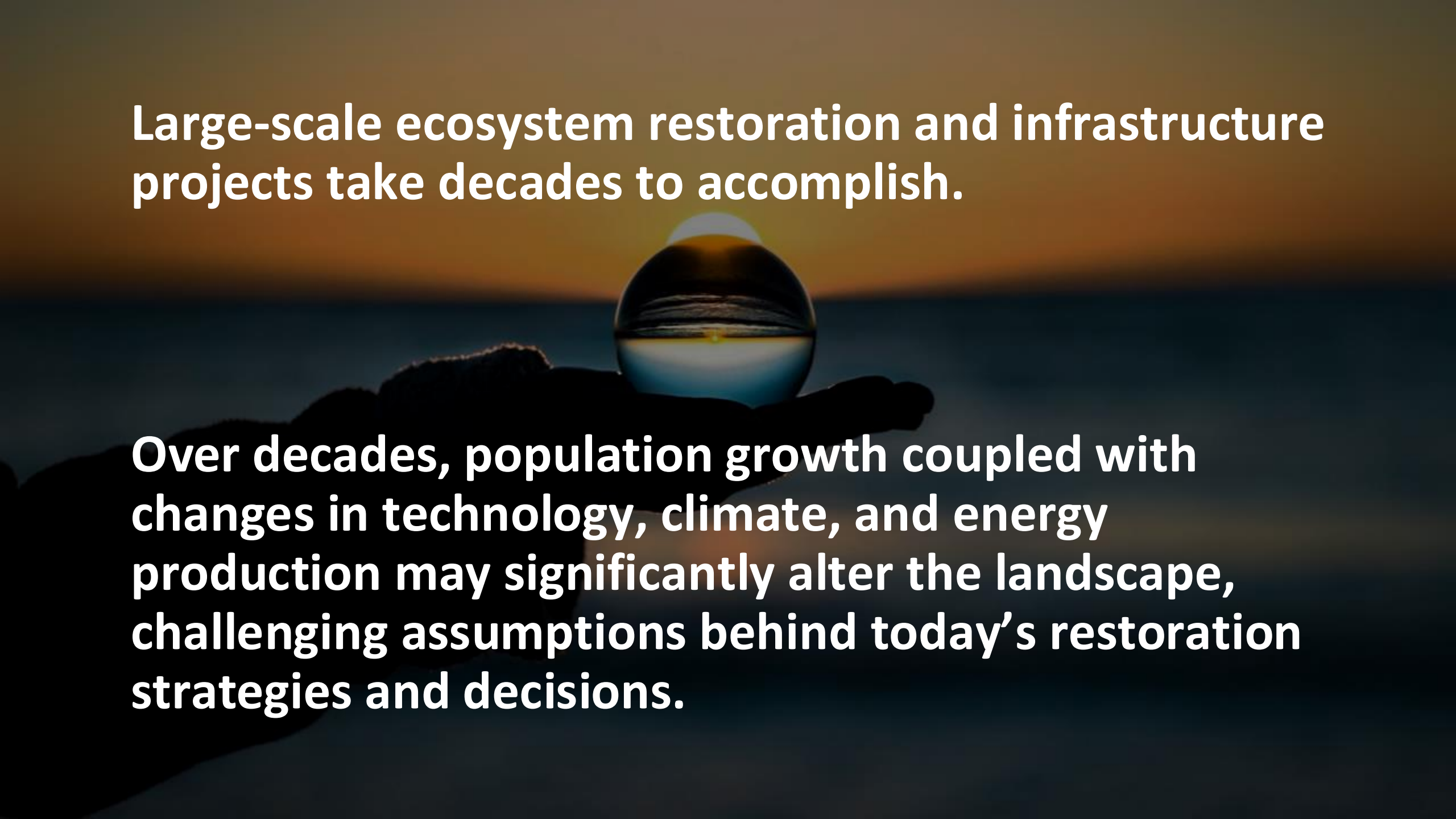
Peter Claggett, Labeeb Ahmed, Michelle Katoski, Sarah McDonald, and Jackie Pickford
U.S. Geological Survey

Joint Urban Stormwater and Land Use Workgroup Meeting
September 23, 2026

A hand holding a globe against a sunset background. The hand is in silhouette, holding a small, transparent globe that reflects the sunset. The background is a blurred sunset over water, with the sun low on the horizon.

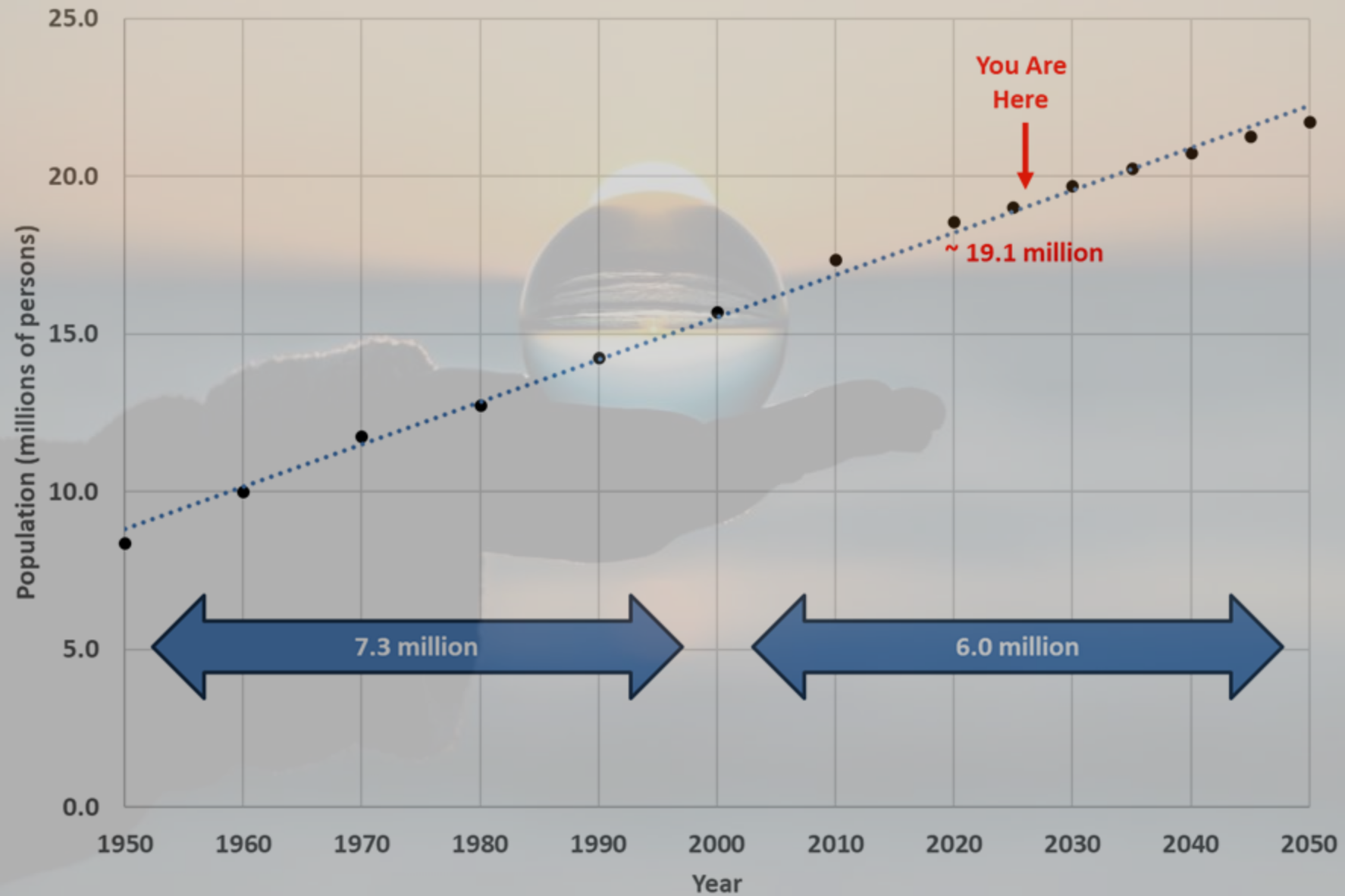
Why Model Future Land Use Conditions?

Large-scale ecosystem restoration and infrastructure projects take decades to accomplish.

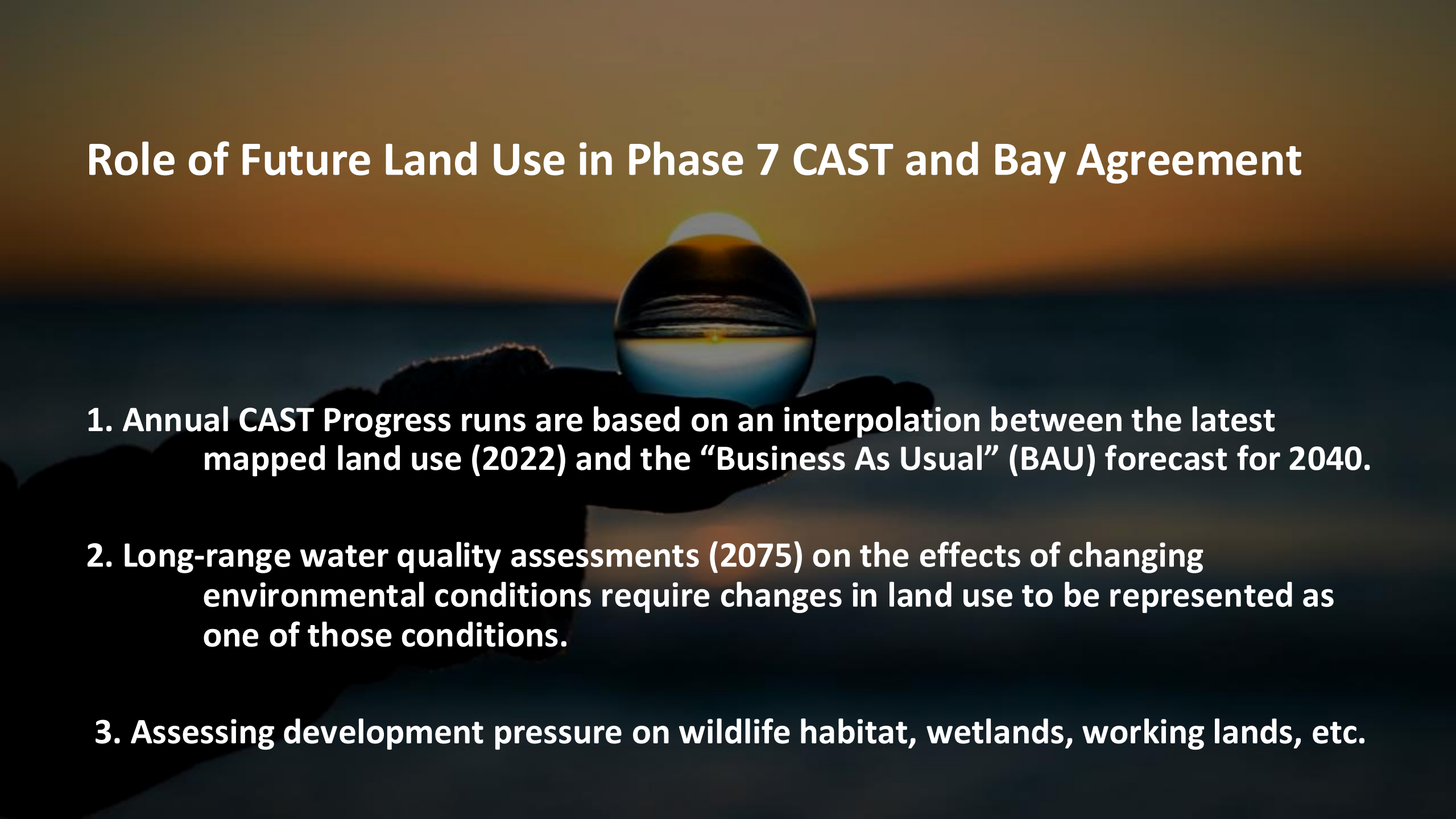
A hand holding a crystal ball over a sunset. The crystal ball shows a reflection of the sunset and the hand holding it. The background is a blurred sunset over a body of water.

Over decades, population growth coupled with changes in technology, climate, and energy production may significantly alter the landscape, challenging assumptions behind today's restoration strategies and decisions.

Population of the Chesapeake Bay Watershed



Role of Future Land Use in Phase 7 CAST and Bay Agreement

A hand holding a crystal ball over a sunset over water. The crystal ball shows a reflection of the sunset and the hand holding it. The background is a sunset over water with a dark silhouette of a hand holding the crystal ball.

1. Annual CAST Progress runs are based on an interpolation between the latest mapped land use (2022) and the “Business As Usual” (BAU) forecast for 2040.
2. Long-range water quality assessments (2075) on the effects of changing environmental conditions require changes in land use to be represented as one of those conditions.
3. Assessing development pressure on wildlife habitat, wetlands, working lands, etc.

Role of the Workgroups & Goal Teams

LUWG: Review and recommend “Business As Usual” (BAU) forecast scenario for the year 2040.

- understand model assumptions, data, and methodology
- recommend analyses, adjustments, and alternative future scenarios

USWG: Review and recommend forecast of solar fields for the “Business As Usual” (BAU) forecast scenario for the year 2040.

- understand model assumptions, data, and methodology
- recommend analyses, adjustments, and alternative future scenarios

CWGT: Approve “Business As Usual” (BAU) forecast scenario for the year 2040.

Final Review & Approval Schedule

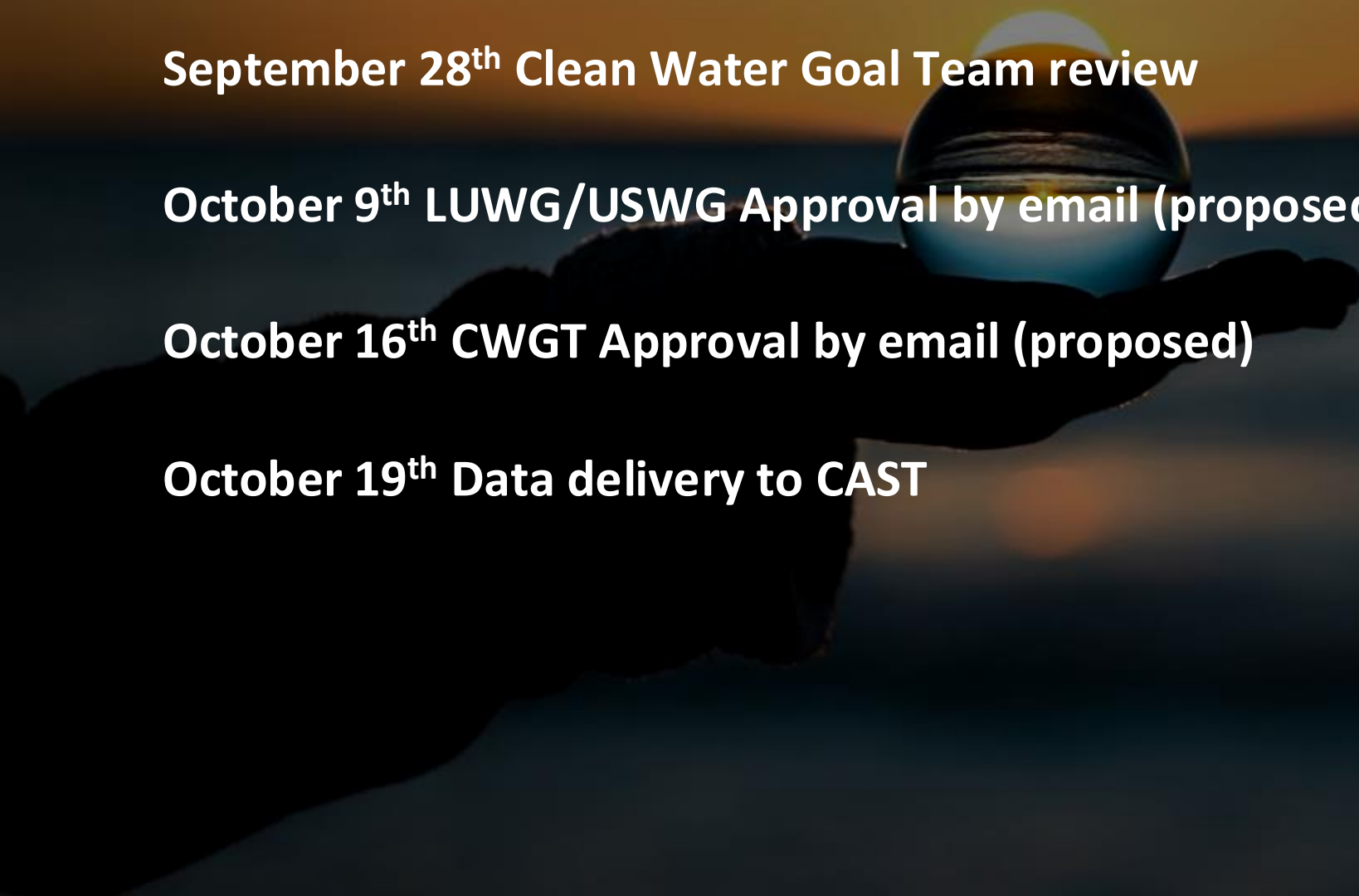
September 23rd Joint LUWG/USWG review

September 28th Clean Water Goal Team review

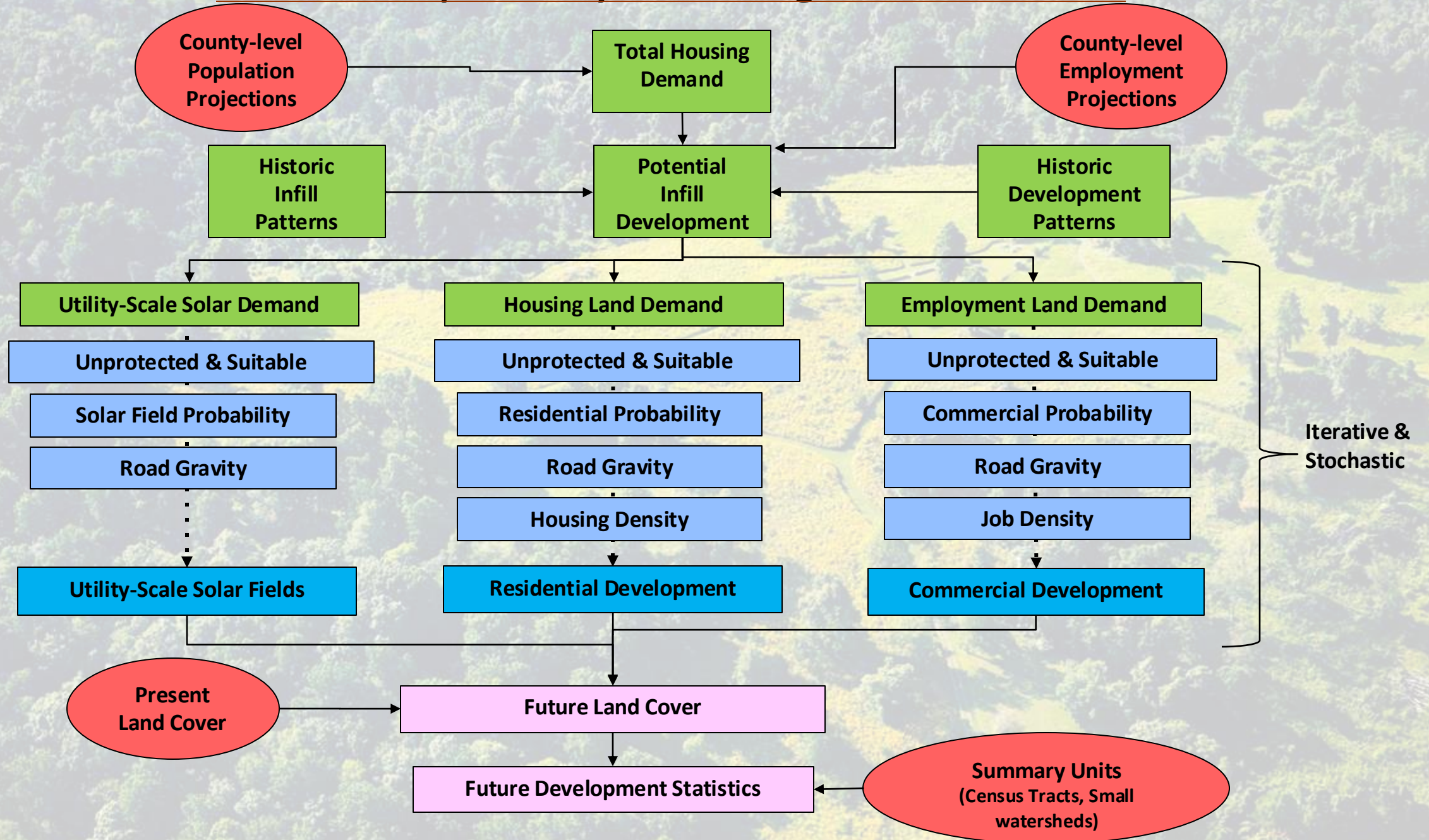
October 9th LUWG/USWG Approval by email (proposed)

October 16th CWGT Approval by email (proposed)

October 19th Data delivery to CAST

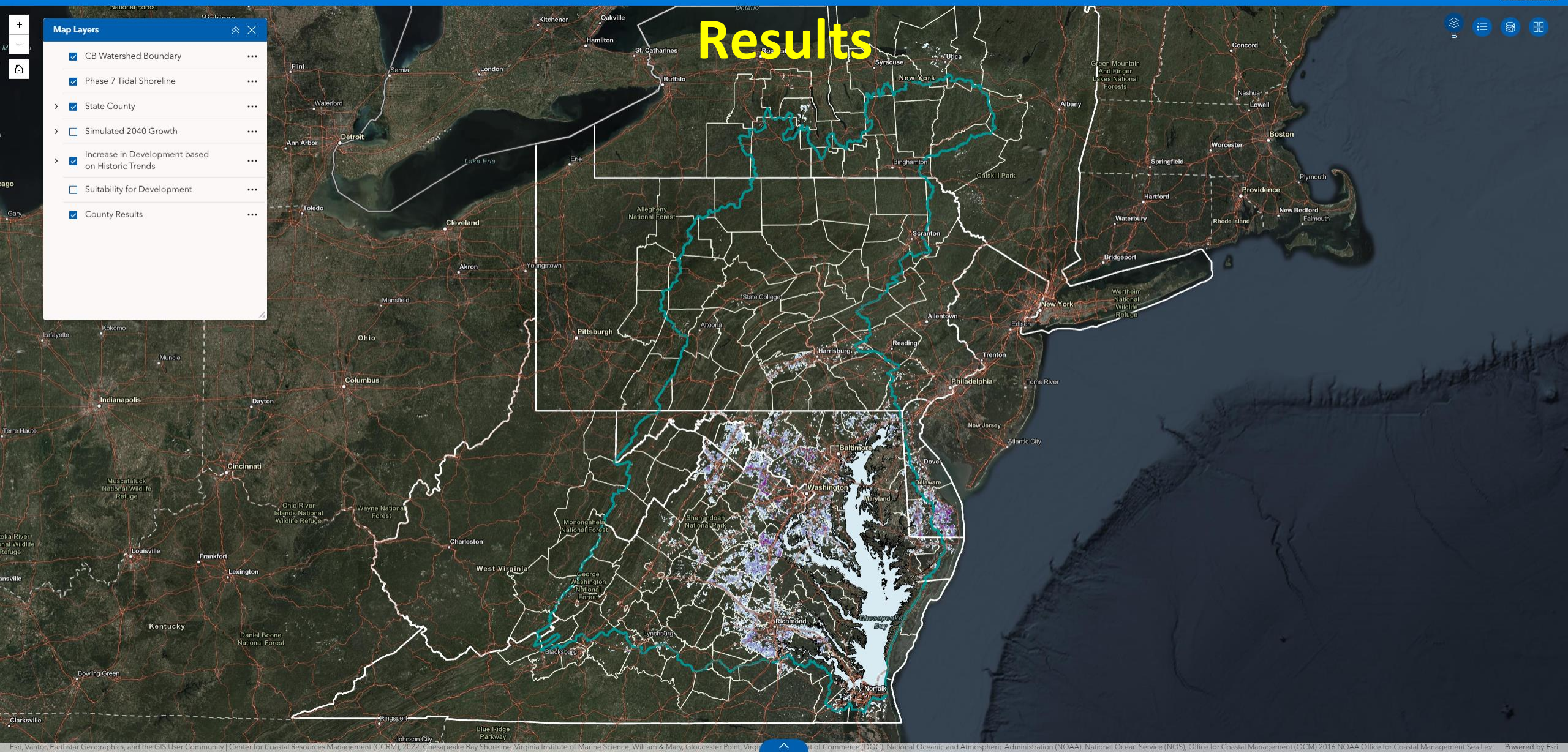


Chesapeake Bay Land Change Model v7



Run #2 to Run #3-ish: Major changes

1. Reduced job density estimates to align with observed high-resolution commercial development trends and Phase 6 model runs (decreased densities by 63%)
2. Updated housing and employment demands
 - Incorporated most recent forecasts from the Baltimore Metropolitan Council
 - Updated population in group housing, average household size, and vacancy rates- all held constant at 2020 levels. Recalculated population in group housing, average household size, and vacancy rates using data from the 2020 Decennial Census in place of data from the American Community Survey.
3. Simulated utility-scale solar fields in all states
 - Updated the solar probability layer with data from 2023-2026
 - Updated existing, planned, and proposed solar field data within information from the Energy Information Agency and Maryland Department of Agriculture.
 - Updated state proportions of existing and proposed solar in the Bay watershed
 - Updated average solar acreage/megawatt empirically using data from the National Photovoltaic Database



<https://gis.chesapeakebay.net/cblcm/>

Results (2020 – 2040)

173,580 acres of residential and commercial development

171,102 acres of utility-scale solar fields

Observed vs Simulated Residential and Commercial Development (annualized from 2020-2040)

Jurisdiction	Residential (acres/housing unit)		Commercial (acres/job)		Residential		Commercial		Housing Units		Jobs	
	2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040
Delaware	0.25	0.25	0.04	0.09	1,067	959	257	211	4,285	3,882	6,977	2,275
District of Columbia	0.00	0.00	0.00	0.00	11	2	9	2	5,365	2,635	5,696	9,284
Maryland	0.14	0.13	0.03	0.02	2,236	2,065	848	630	15,707	15,857	28,322	29,807
New York	0.34	0.28	1.67	0.07	769	294	291	88	2,252	1,058	174	1,183
Pennsylvania	0.44	0.16	0.12	0.05	3,347	701	1,371	328	7,567	4,419	11,294	6,512
Virginia	0.17	0.21	0.03	0.03	4,483	4,815	1,563	1,463	26,936	22,993	55,481	41,982
West Virginia	0.43	0.30	0.07	0.09	345	345	84	105	796	1,159	1,142	1,123
Region	0.19	0.18	0.04	0.03	12,257	9,180	4,422	2,827	62,907	52,003	109,084	92,165

Annualized Land Conversion from Residential and Commercial Development (2020-2040)

Jurisdiction	Urban Conversion	Natural Land Conversion		Farmland Conversion		Forest : Farmland Ratio	
		2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040
Delaware	1,009	340	480	317	528	1.07	0.91
District of Columbia	4	14	4	-	-	0.00	0.00
Maryland	2,011	1,401	1,308	548	703	2.56	1.86
New York	286	545	146	386	141	1.41	1.04
Pennsylvania	885	2,531	340	1,459	545	1.73	0.62
Virginia	4,144	3,997	3,114	1,022	1,030	3.91	3.02
West Virginia	341	247	130	110	211	2.24	0.62
Region	8,679	9,075	5,521	3,843	3,158	2.36	1.75

Annualized Land Use Change from Residential and Commercial Development (2020-2040)

Jurisdiction	Urban Conversion	Natural Land Conversion		Farmland Conversion		Forest : Farmland Ratio	
		2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040
Delaware	1,170	340	641	317	528	1.07	1.21
District of Columbia	4	14	4	-	-	0.00	0.00
Maryland	2,696	1,401	1,993	548	703	2.56	2.84
New York	382	545	241	386	141	1.41	1.72
Pennsylvania	1,029	2,531	484	1,459	545	1.73	0.89
Virginia	6,278	3,997	5,248	1,022	1,030	3.91	5.09
West Virginia	449	247	238	110	211	2.24	1.13
Region	12,007	9,075	8,849	3,843	3,158	2.36	2.80

Annualized Land Conversion from Utility-scale Solar Field Development (2020-2040)

Jurisdiction	Solar Conversion	Natural Conversion	Farmland Conversion	Forest:Farmland Ratio
		2020-2040	2020-2040	2020-2040
Delaware	162	29	132	0.22
District of Columbia	3	3	-	0.00
Maryland	835	176	659	0.27
New York	1,949	455	1,494	0.30
Pennsylvania	943	312	631	0.49
Virginia	4,407	2,572	1,835	1.40
West Virginia	257	99	158	0.63
Region	8,555	3,645	4,910	0.74

Addressing Utility-Scale Solar Fields

Future USS Fields (**recently built**, planned, proposed)

	A	B	C	D	E	F	G	H	I	J
Jurisdiction	USS_21	USS_25	MW(USS)_2025	MW(TOT)_2025	% USS_MW	% ChesBay	Acres/MW	MW_2030	MW_2035	MW_2040
DE	142	437	95	352	27%	100%	6.14	648	449	651
DC	0	31	15	350	4%	100%	2.75	298	291	422
MD	1,557	4,759	871	3,200	27%	100%	5.47	2,600	2,604	3,774
NY	1,307	12,705	2,702	8,200	33%	38%	6.30	12,400	9,250	13,404
PA	619	3,827	999	3,200	31%	68%	5.14	5,100	3,727	5,401
VA	4,993	21,868	4,699	7,800	60%	68%	6.24	9,100	7,589	10,996
WV	-	423	140	383	37%	87%	4.03	1,517	853	1,236
Source:	2021/22 High-res LULC	USGS-LBL & MDA database	USGS-LBL & MDA database	SEIA	C/D		B/C	SEIA	$((D+H)*(1.077)^5) - (D+H)$	$((D+H)*(1.077)^{10}) - (D+H+I)$

K	L	M	N	O	P
SOL_25	RSOL30	RSOL35	RSOL40	Total	% Total Acres
295	1,078	747	1,082	3,203	1.9%
31	36	35	50	152	0.1%
3,202	3,867	3,874	5,613	16,556	9.7%
11,398	9,659	7,206	10,441	38,704	22.8%
3,208	5,555	4,059	5,882	18,704	11.0%
16,875	23,228	19,370	28,068	87,542	51.5%
423	1,961	1,103	1,598	5,084	3.0%
B-A	$(E*F*G*H)$	$(E*F*G*I)$	$(E*F*G*J)$	K+L+M+N	$O / ?(O)$

Note: From Run #2 to Run #3, demand changed mostly in Maryland due to the inclusion of mapped solar fields from the Maryland Department of Agriculture. Minor changes in other jurisdictions relate to

Addressing Data Centers

- The FracTracker database shows 241 data centers are operating or approved in the Chesapeake Bay region. Of those, 168 are present in the 2021/22 high-res land use data and 73 are not but will be mapped in the 2025/26 high-res land use data used to update Phase 7 CAST in 2029-ish.
- An additional 360 data centers are proposed in the Chesapeake Bay watershed counties.
- The direct land use change impact from future data centers may be the equivalent to 360 Walmarts. However, secondary impacts may be significant including water use, air pollution from diesel generators, new transmission lines and pipelines, local and regional energy generation?

Jurisdiction	Cleanview			FracTracker				IM3	S&P Global
	Operating	Planned	Total (#)	Operating	Approved	Planned	Total (#)	Operating	Operating/Planned
Delaware	-	1	1						2
District of Columbia			-						10
Maryland	6	9	15	3	1	9	13	8	27
New York	12	25	37	17	2	11	30	16	82
Pennsylvania	15	93	108	45	6	47	98	8	77
Virginia	371	458	829	214	12	221	447	281	458
West Virginia		11	11		2	2	12	15	2

CBLCM Review Resources

CBLCM Frequently Asked Questions (a must read): available as a download from the CBLCM Viewer

CBLCM Viewer: <https://gis.chesapeakebay.net/cblcm/>

Peer-reviewed Journal Article:

<https://onlinelibrary.wiley.com/doi/10.1111/1752-1688.13131>

available for free on CWGT 7/27 meeting page

Project Lead: pclaggett@usgs.gov , 410-490-1202



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