

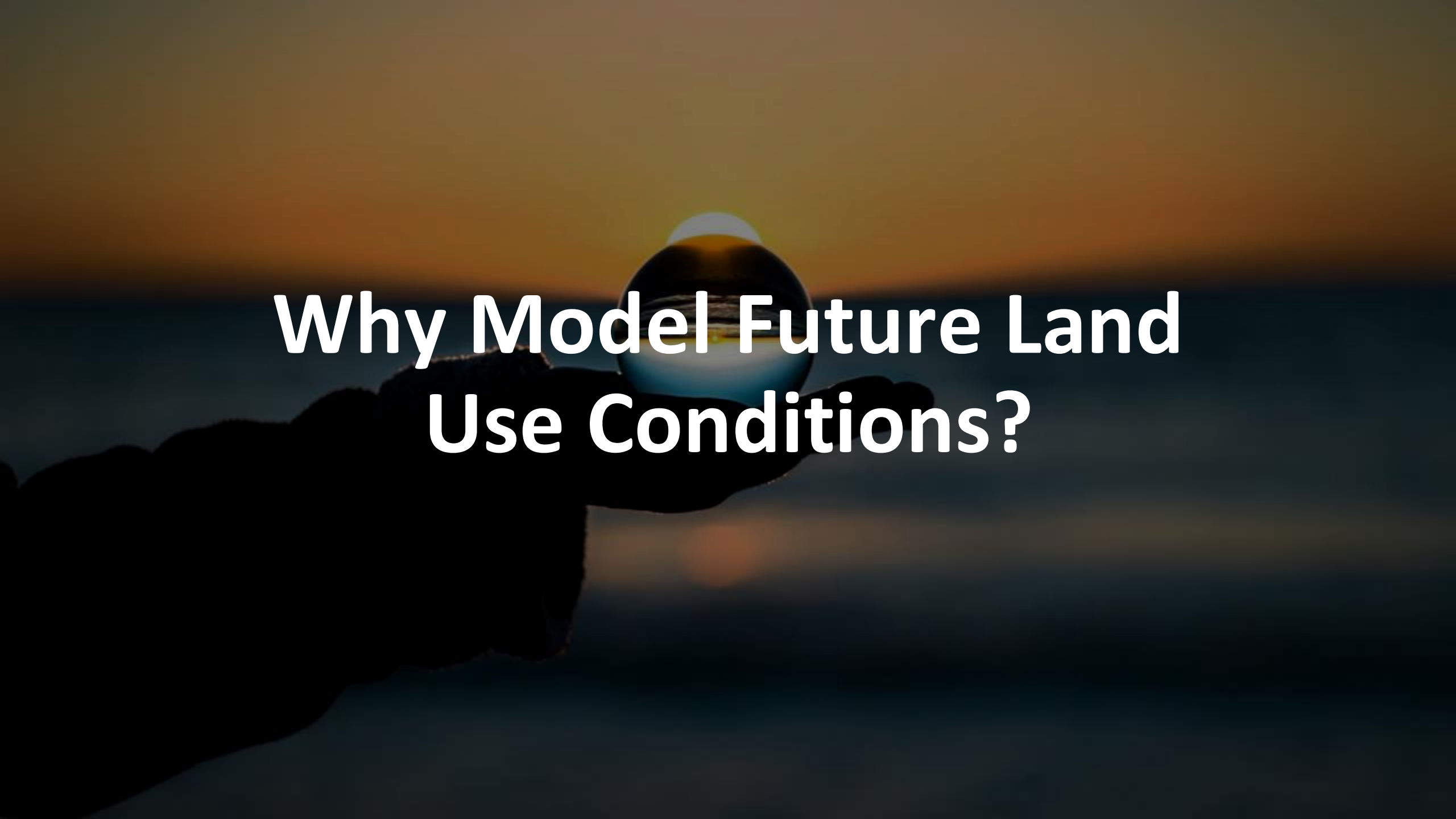


Phase 7 2040 Land Use “Business-As-Usual” Scenario

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

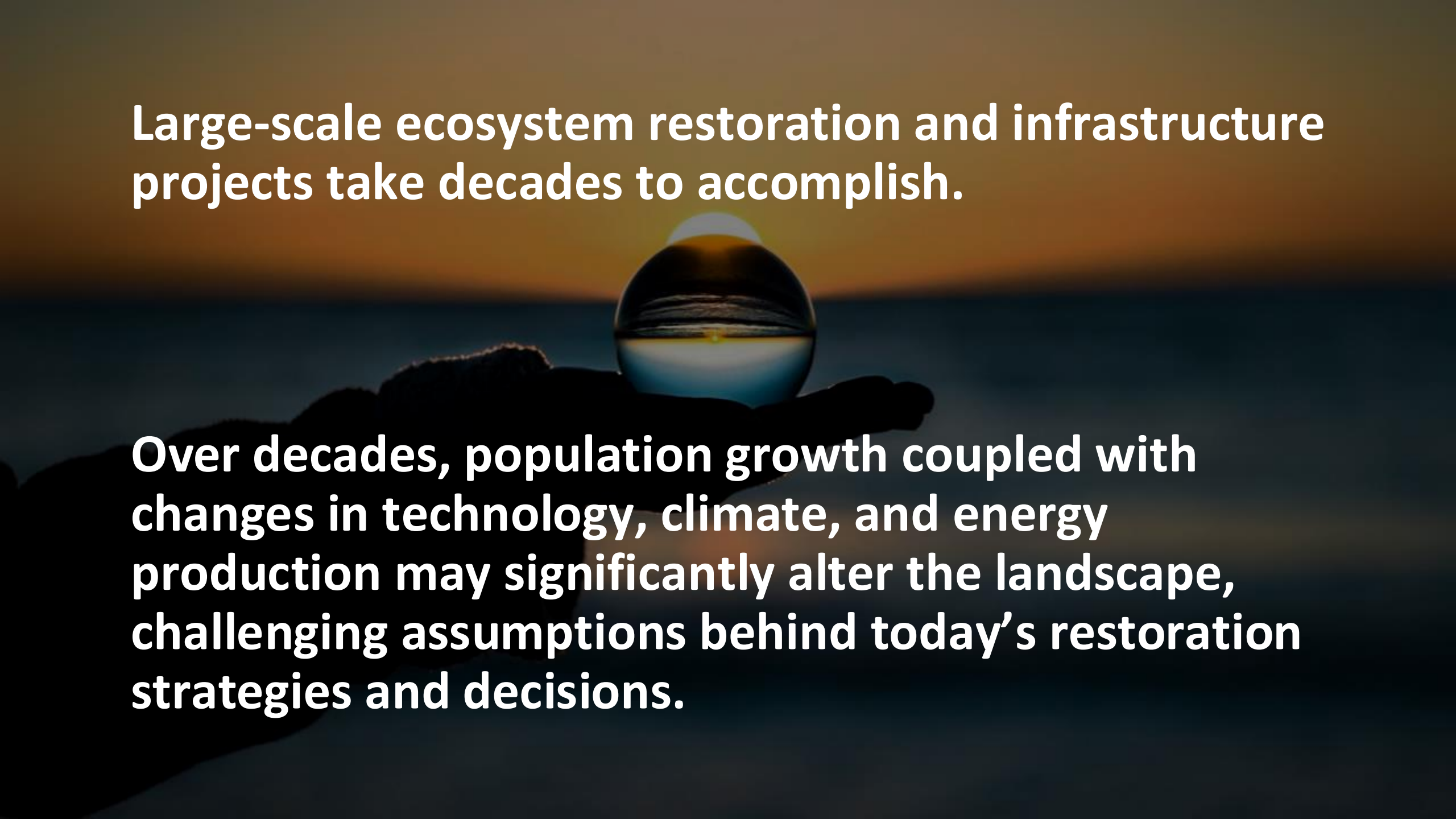
Peter Claggett, Labeeb Ahmed, Michelle Katoski, Sarah McDonald, and Jackie Pickford
U.S. Geological Survey

Clean Water Goal Team Meeting
September 28, 2026

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

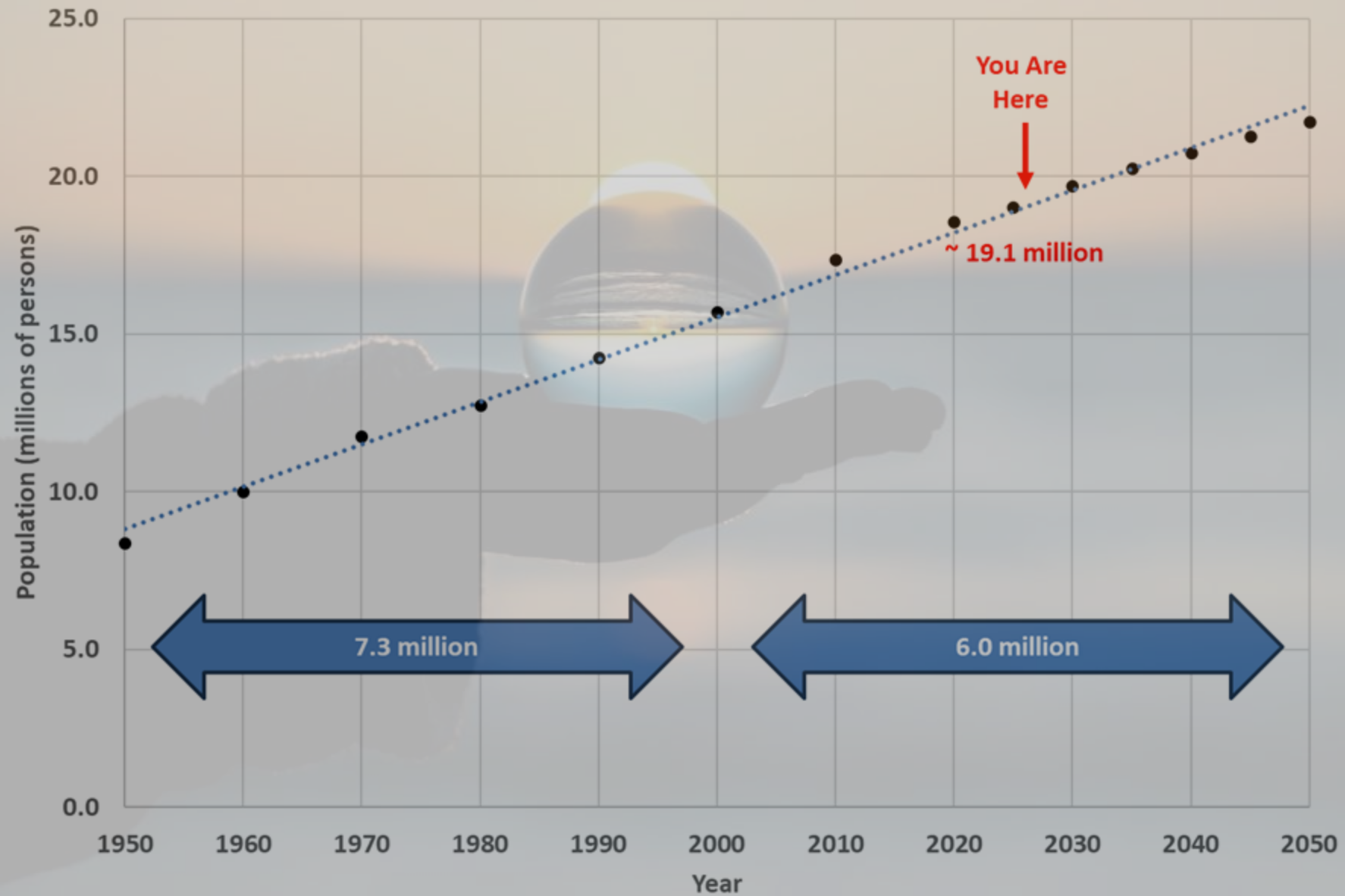
Why Model Future Land Use Conditions?

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

A hand holding a crystal ball over a sunset over the ocean. The crystal ball reflects the sunset and the ocean. The background is a blurred sunset over the ocean.

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 Scenarios in Phase 7 CAST

1. Establish the 2040 baseline land use condition

- informs development of Watershed Implementation Plans
- informs all “what if” scenarios in CAST
- informs all annual progress runs (land use conditions in progress years represent an interpolation between 2022 and 2040)
- updated with scheduled updates to CAST for incorporating new data

2. Develop “Land Use Policy BMPs”

- alternative future land use conditions representing planned policies or programs that impact the quantity and location of urban growth and/or the development of utility-scale solar fields.
- incorporated into CAST
- may be incorporated into Watershed Implementation Plans to represent and quantify impacts of programmatic implementation and land conservation.

3. Evaluate the effects of changing environmental conditions on water quality through the year 2075.

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

A hand holding a glass sphere with a sunset scene inside, set against a background of a sunset over water.

September 23rd Joint LUWG/USWG review

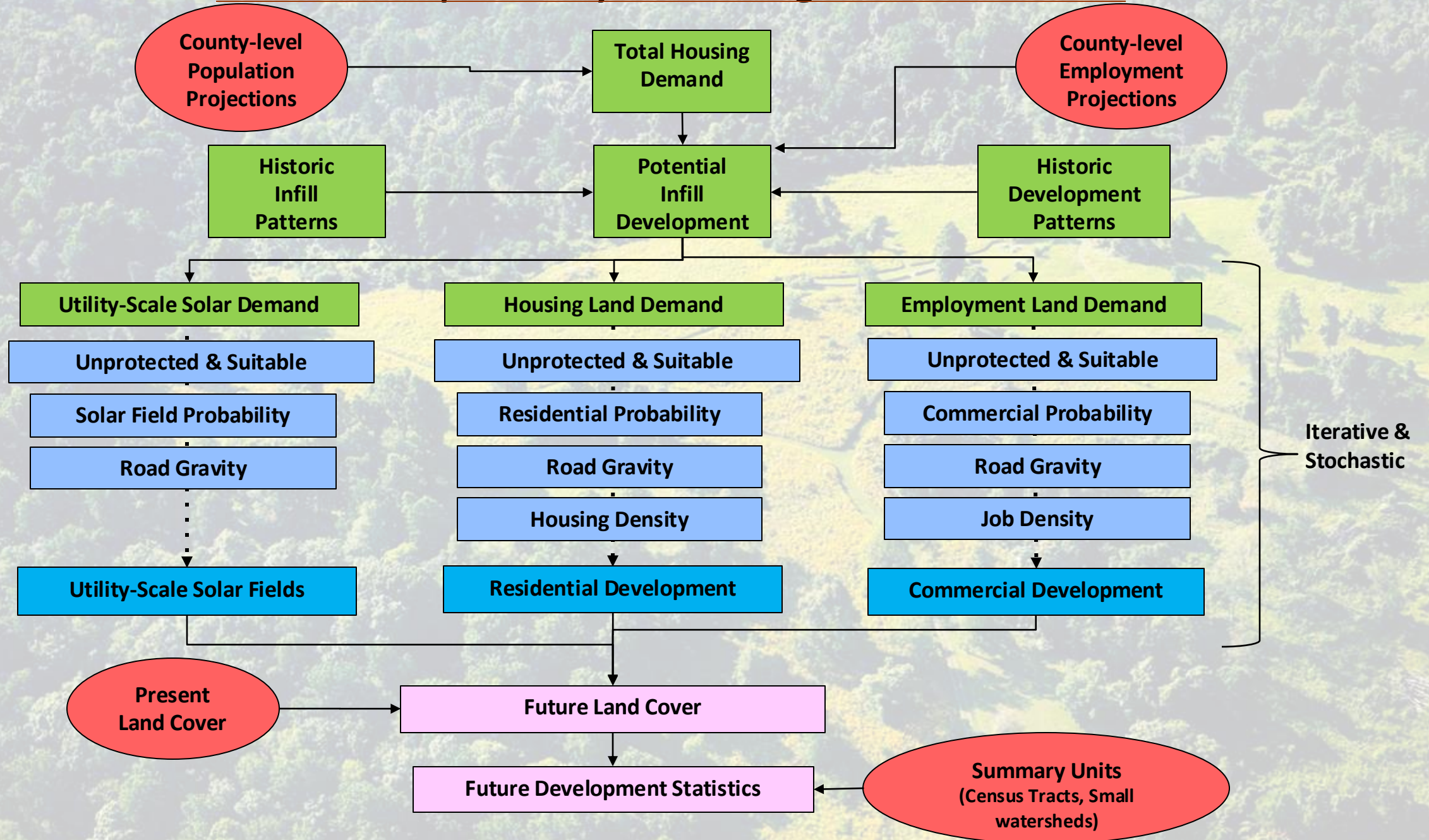
September 28th Clean Water Goal Team review

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



CBLCM v7: What's changed since Phase 6 (A LOT)

- Mapped all residential and commercial areas with tax parcel and high-res land use data- used to estimate residential and commercial densities and land suitability
- Developed equations to estimate impervious surface from parcel size.
- Refined measures of infill and redevelopment using parcel and high-res land use data
- Estimated residential and commercial growth probabilities using high-res land use change data
- Mapped sewer service areas with parcel data
- Simulated growth in utility scale solar fields using industry data and time series Sentinel satellite data (Chesapeake Conservancy).
- Incorporated “no growth” areas from Municipal Planning Organizations across the watershed.
- Updated all demographic variables with data from the 2020 Census

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)

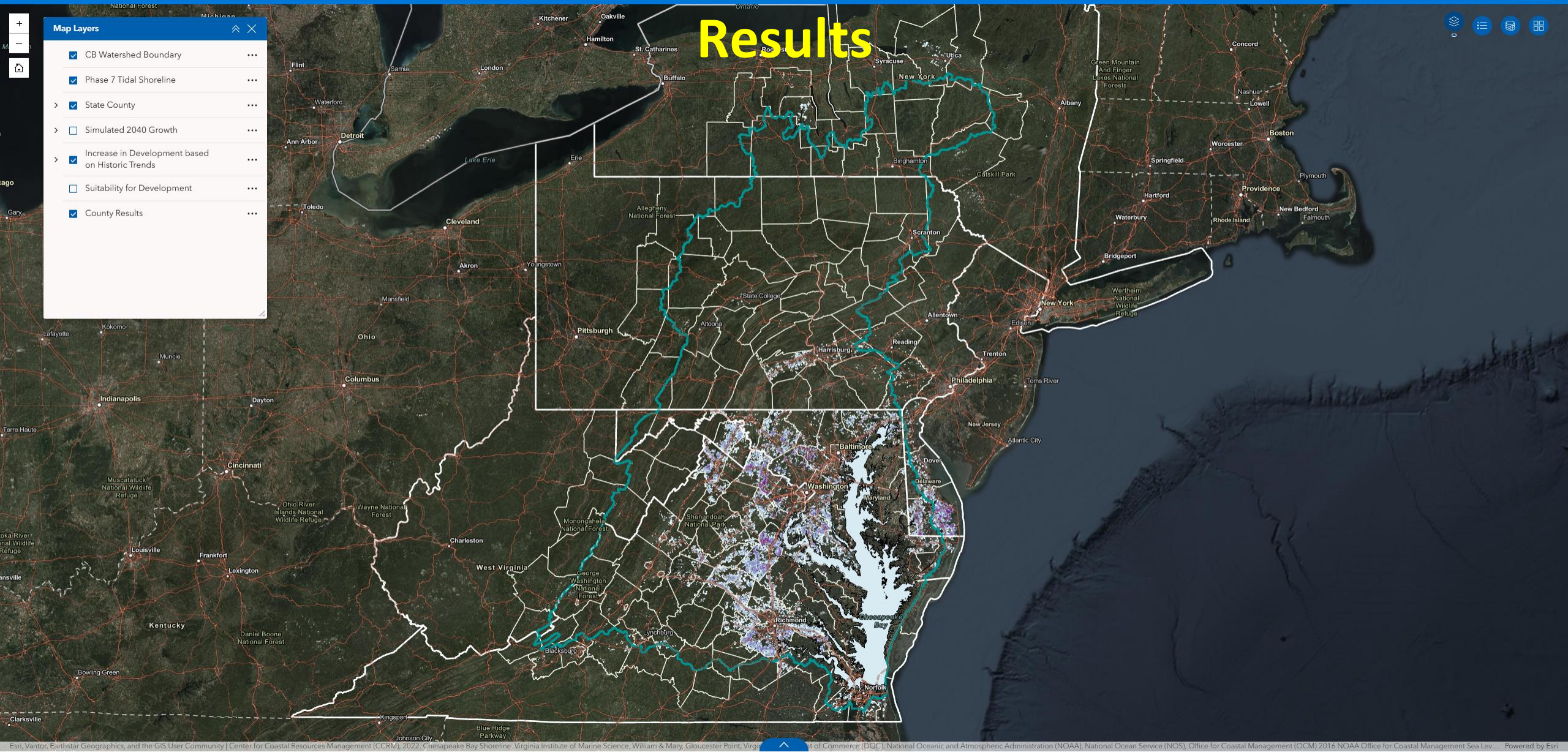
Jurisdiction	Urban Conversion	Natural Land Conversion		Farmland Conversion		Forest : Farmland Ratio	
		2010-2020	2020-2040	2010-2020	2020-2040	2010-2020	2020-2040
Delaware	1,009	340	480	317	528	1.07	0.91
District of Columbia	4	14	4	-	-	0.00	0.00
Maryland	2,011	1,401	1,308	548	703	2.56	1.86
New York	286	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



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

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?).
- An additional 360 data centers are proposed in the Chesapeake Bay watershed counties.
- The direct land use change impact from all existing and currently proposed data centers is roughly equivalent to the addition of ~600 Walmarts. However, secondary impacts may be significant including water use, air pollution from diesel generators, new transmission lines and pipelines, and additional energy generation.

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

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