



Development of the SANDAG ABM2+ Application Tool

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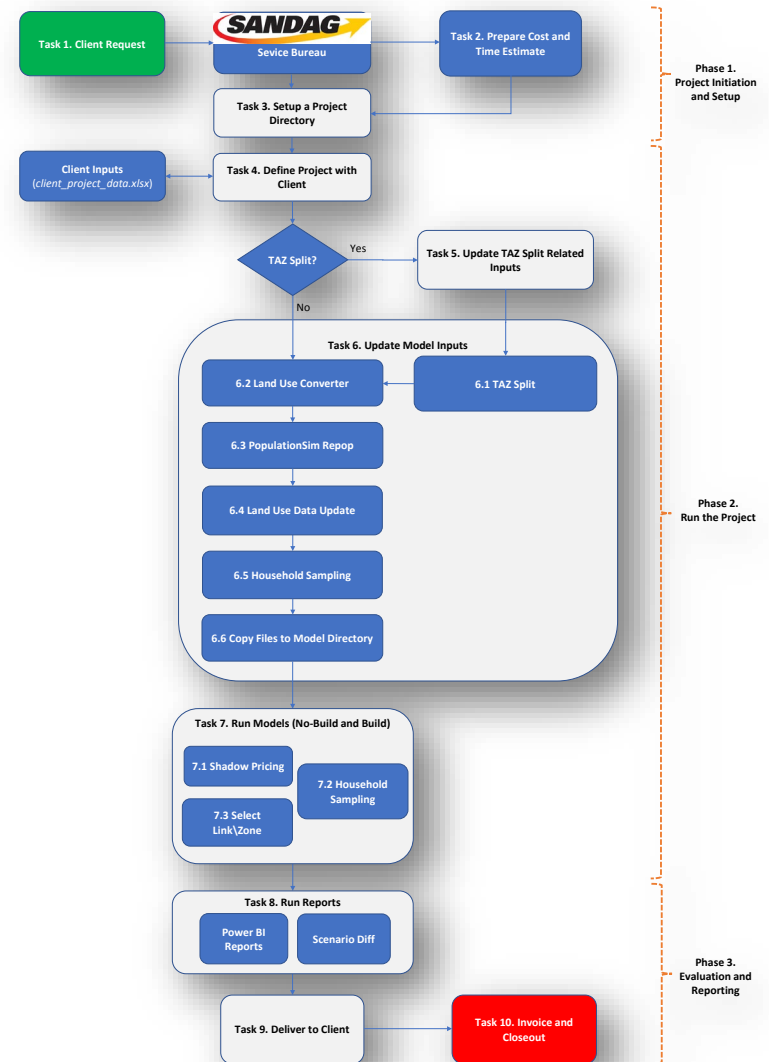
SANDAG Overview

- San Diego Associate of Governments
- Resident travel model is based on the CT-RAMP family of activity-based models.
- Regional model applications are done in house by the Service Bureau

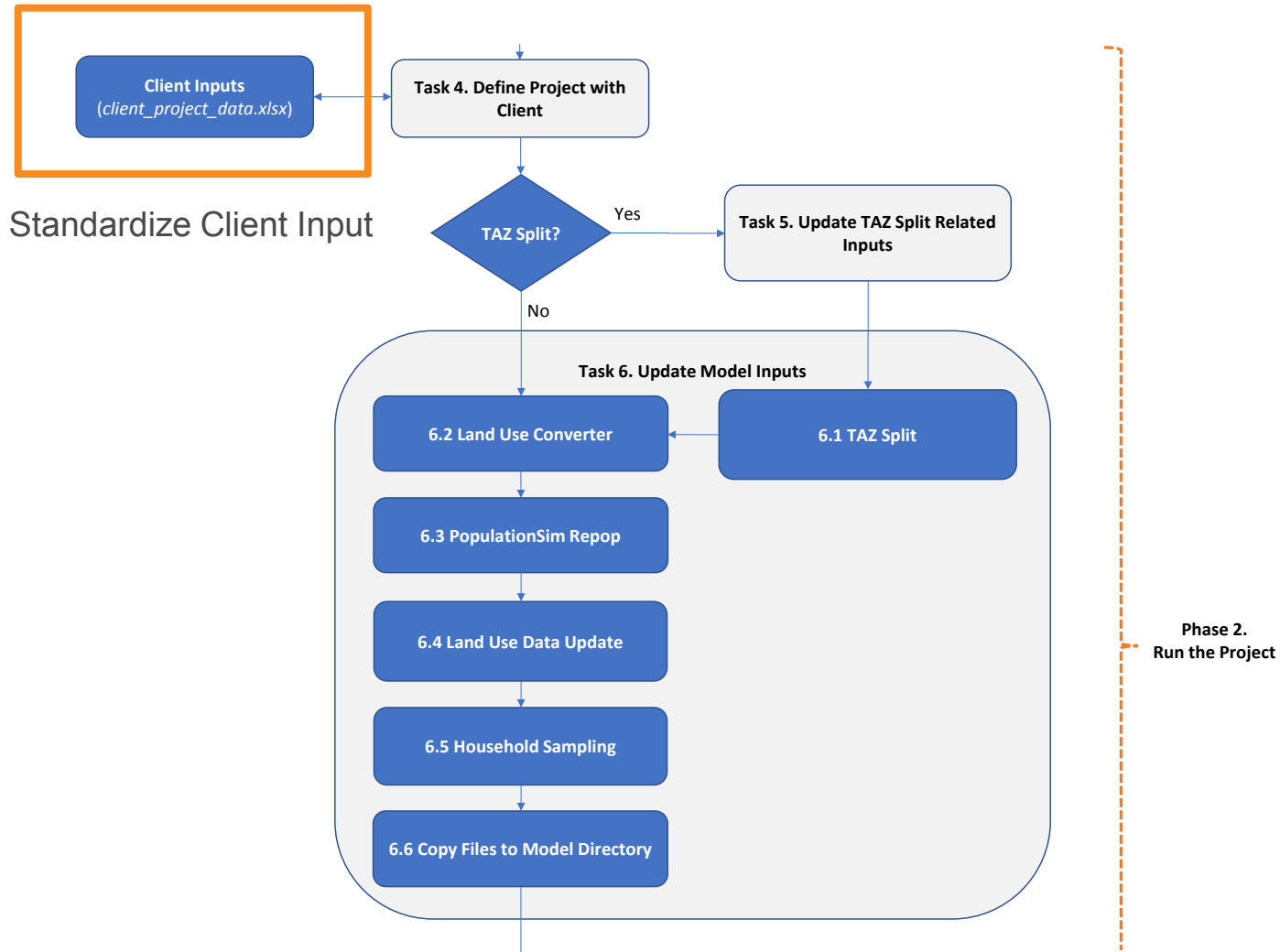


ABM2+ Application Tool Overview

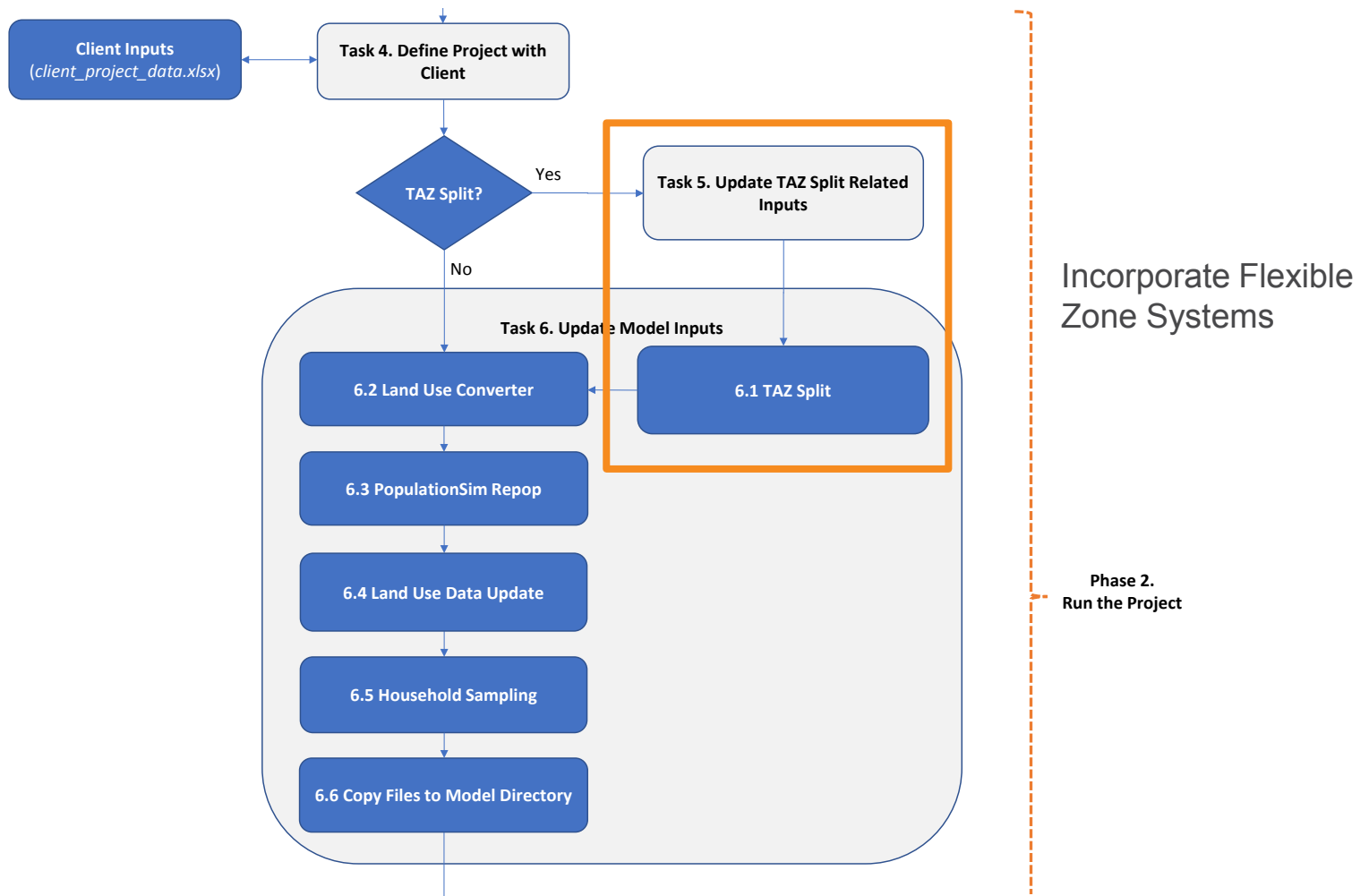
- Standardized workflow for Land Use Service Bureau projects in 3 phases:
 - Client Request
 - In-house Modelling
 - Reporting and Delivery



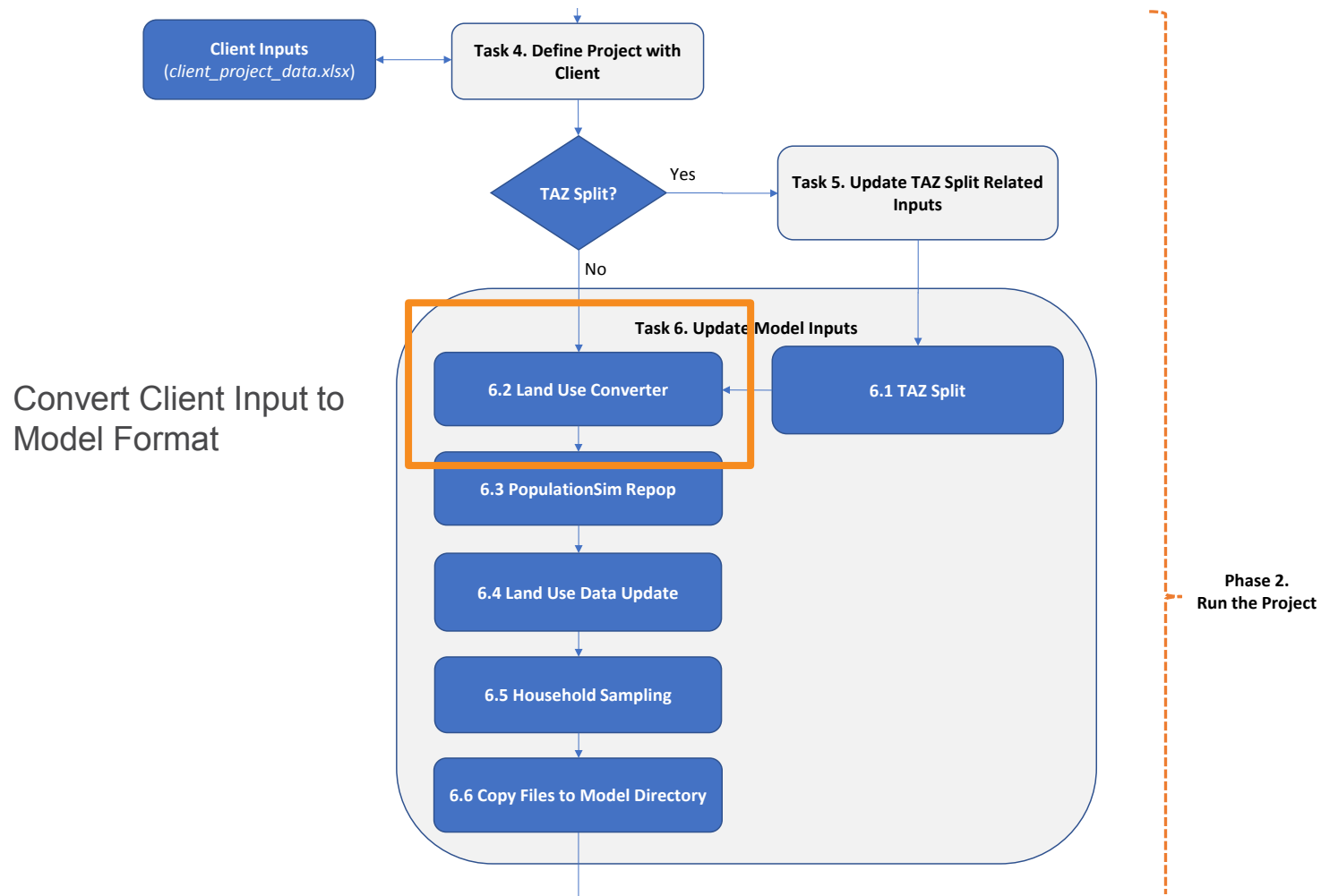
ABM2+ Application Tool Client Inputs



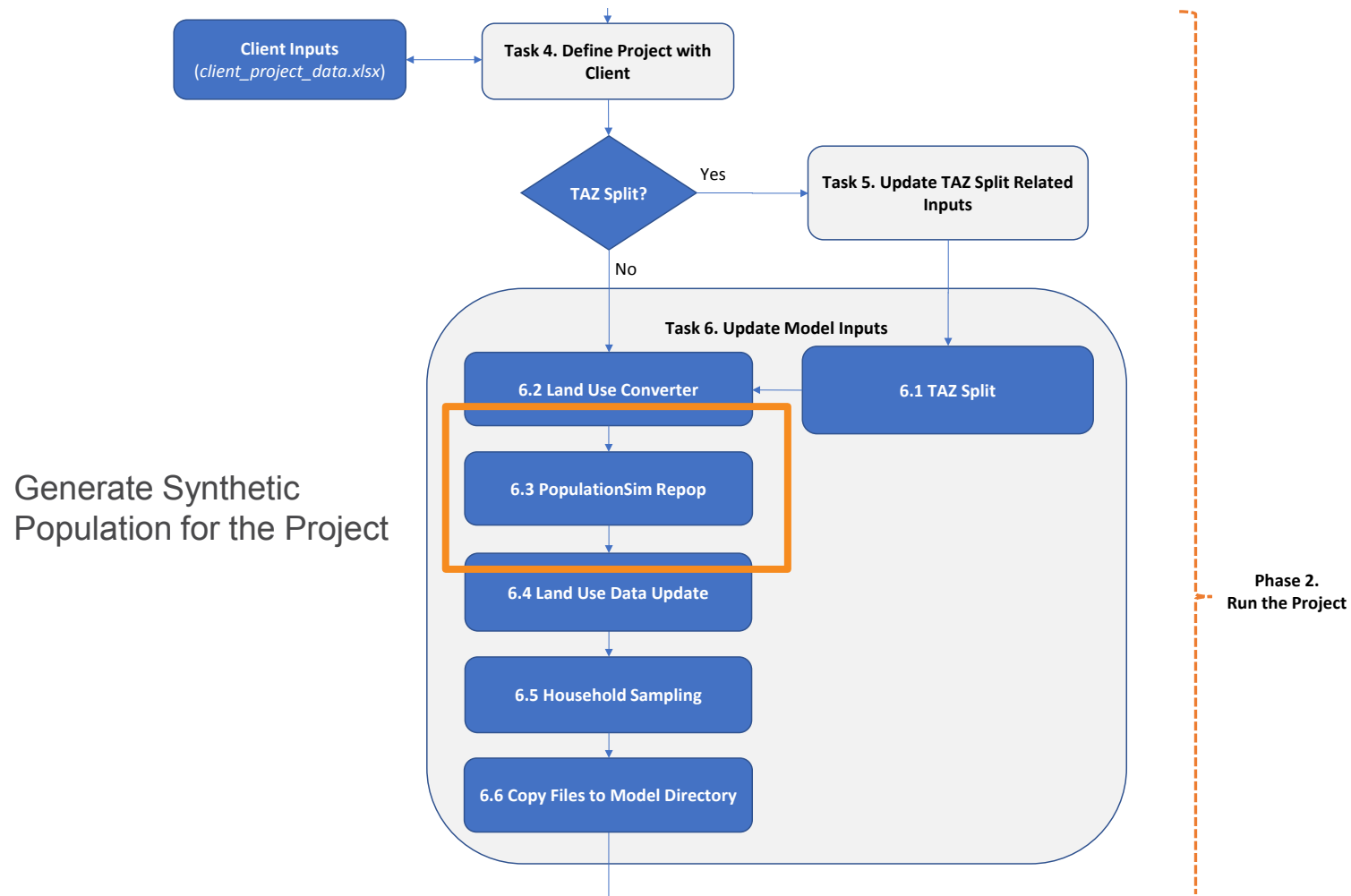
ABM2+ Application Tool TAZ Splits



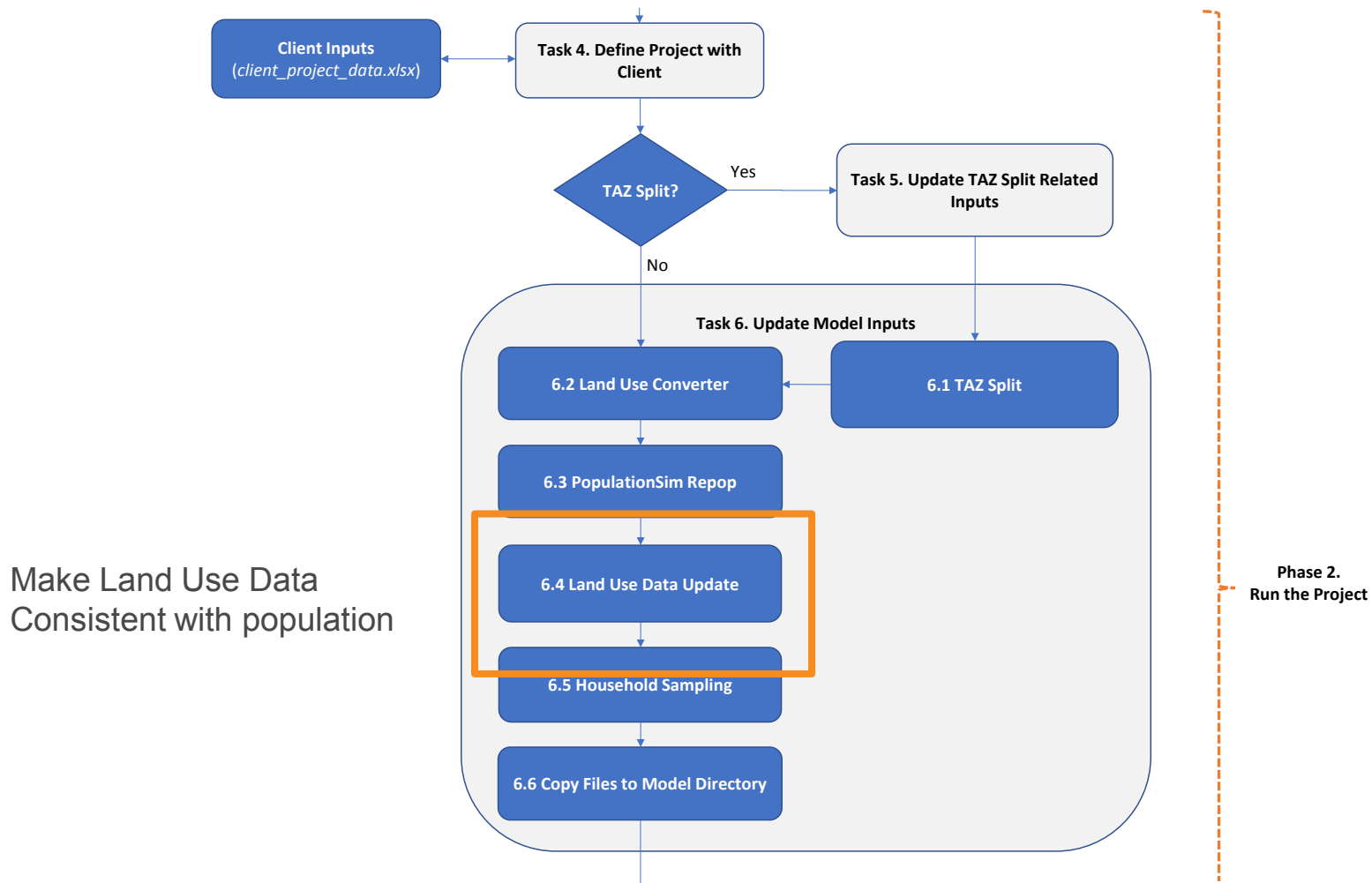
ABM2+ Application Tool Land Use Converter



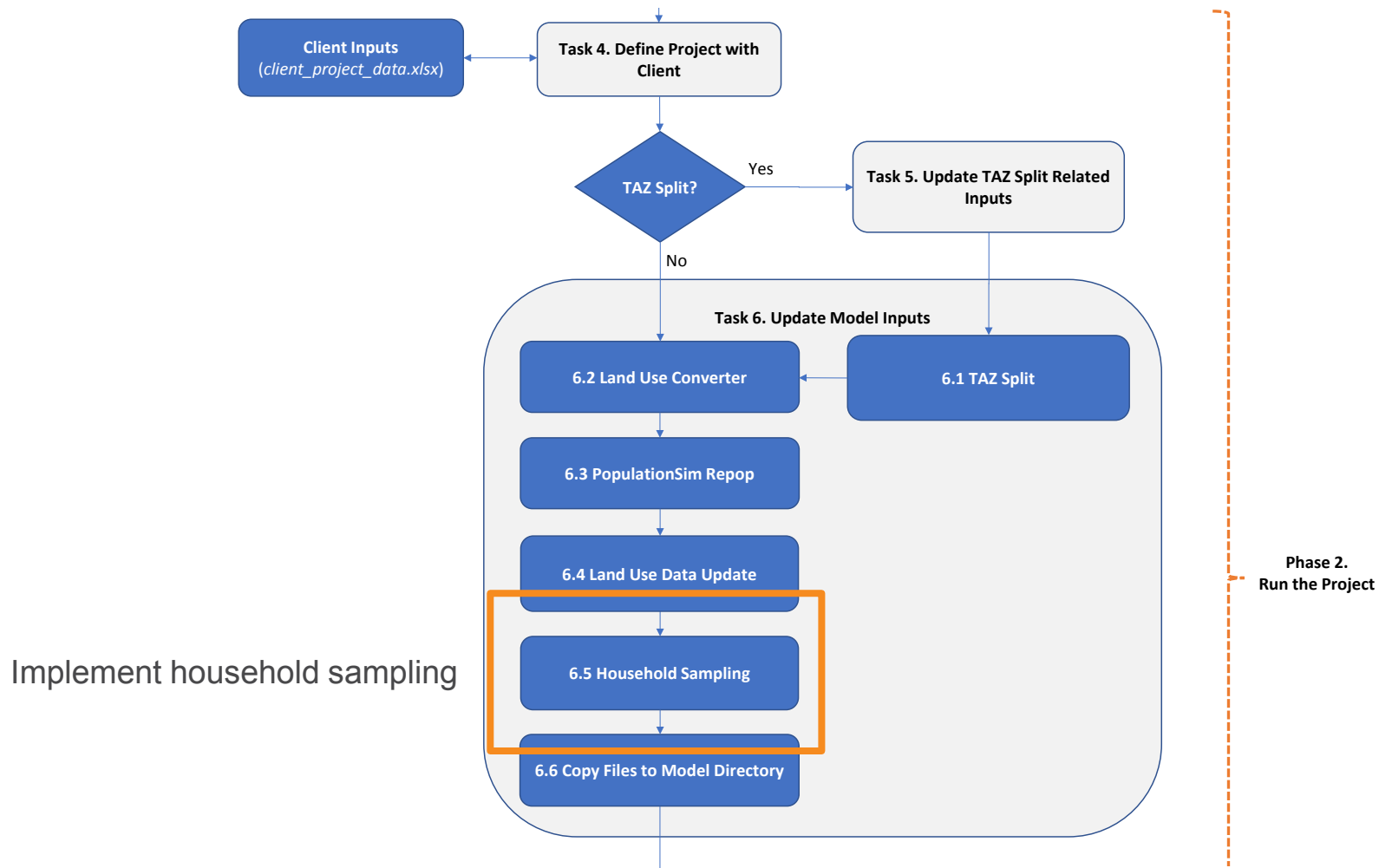
ABM2+ Application Tool Repop



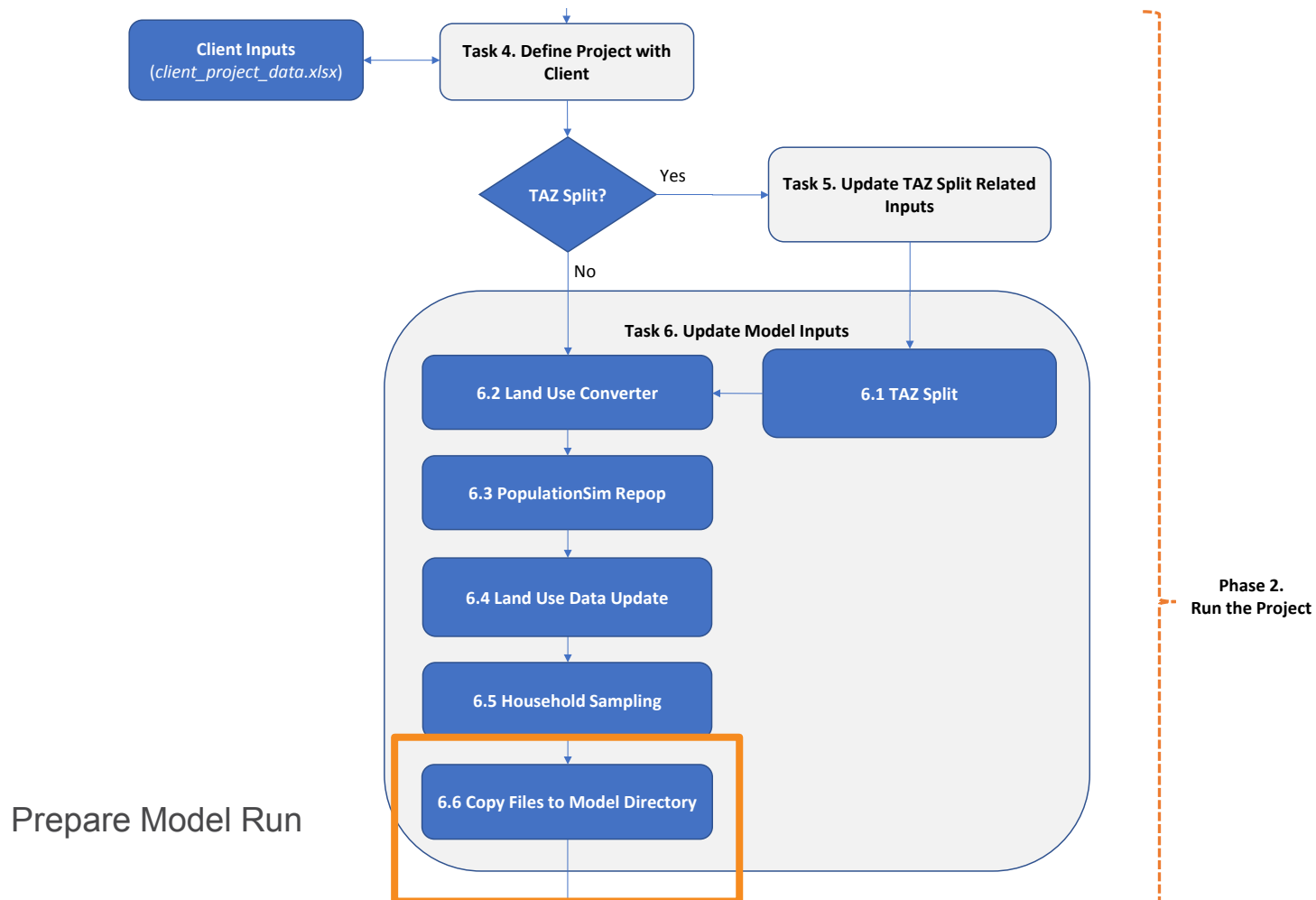
ABM2+ Application Tool Land Use Data Update



ABM2+ Application Tool Household Sampling



ABM2+ Application Tool **Model Run Prep**





Client Inputs

Land Use Converter

- Standardized client input spreadsheet.
- References included:
 - ReadMe
 - Land Use Descriptions
 - Example project

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	lu_code	LU Description	MGRA	Dwelling Unit	Share Affordable	Acre	Employee	Thousand Square Feet (KSF)	Hotel Rooms	Beds	Students	Pumps	Spaces	Seats	Screens	Enplanement	Berths
2	101	Single Family Residential															
3	102	Multi-Family Residential															
4	103	Mobile Home Park															
6	1402	Dormitory															
13	1501	Hotel (Low-Rise)															
21	2101	Industrial Park															
33	4101	Commercial Airport															
39	4114	Parking Lot - Surface															
56	5008	Service Station															
129	6101	Cemetery															
144	6502	Hospital - General															
159	6806	Elementary School															
168	7207	Marina															
171	7210	Other Recreation - High															
173	7601	Park - Active															
195																	

Project Data

Project Summary

Project_Data_Example

HotelRoomShare

Land Use Descriptions



Land Use Converter **Mixed Use Example**

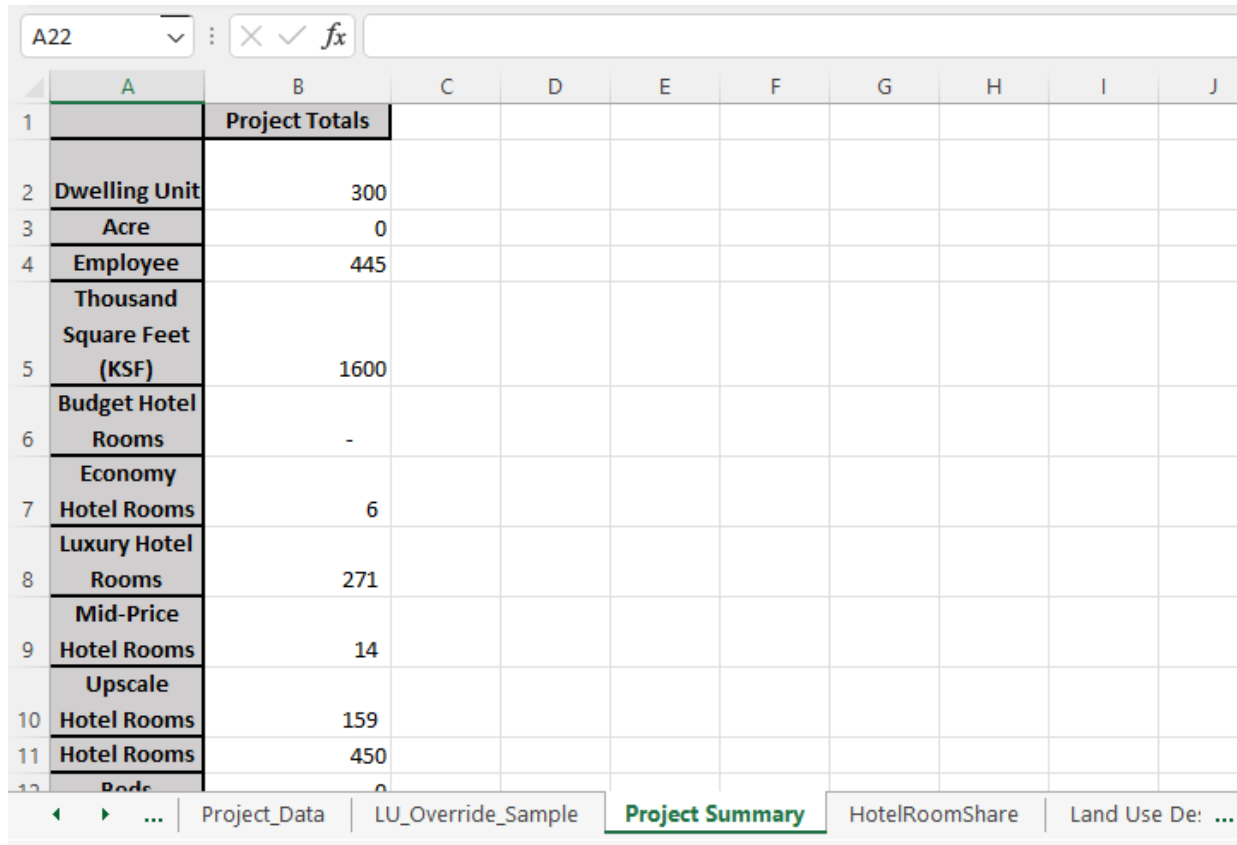
- Sample high density mixed-use development.

	A	B	C	D	F	G	H	I	J	K
1	lu_code	LU Description	MGRA	Dwelling Unit	Acre	Employee	Thousand Square Feet (KSF)	Hotel Rooms	Beds	Students
3	102	Multi-Family Residential	3093	300						
4	1502	Hotel (High-Rise)	3093					450		
5	4111	Rail Station/Transit Center	3093			25				
6	5003	Community Shopping Center (100000 SF or more)	3093				250			
7	6001	Office (High-Rise - greater than 100000 SF)	3093				1350			
8	6003	Government Office/Civic Center	3093			420				
9	101	Single Family Residential								
10	102	Multi-Family Residential								
11	103	Mobile Home Park								



Land Use Converter **Quality Control**

- Built-in QA/QC allows clients initial broad view of project land use



	A	B	C	D	E	F	G	H	I	J
1		Project Totals								
2	Dwelling Unit	300								
3	Acre	0								
4	Employee	445								
5	Thousand Square Feet (KSF)	1600								
6	Budget Hotel Rooms	-								
7	Economy Hotel Rooms	6								
8	Luxury Hotel Rooms	271								
9	Mid-Price Hotel Rooms	14								
10	Upscale Hotel Rooms	159								
11	Hotel Rooms	450								
12	Bedrooms	0								

Project_Data | LU_Override_Sample | **Project Summary** | HotelRoomShare | Land Use De: ...





Update Model Inputs

1. TAZ Split

- In-house GIS process for splitting TAZs is incorporated in the workflow.
 - If TAZ split is detected, necessary model inputs are updated.
 - UEC Updates
 - Configuration Setting Updates
 - New crosswalk is incorporated in all land use updates.



2. Land Use Converter

- Automatically converts client inputs into model inputs.
 - Employment
 - Households/Group Quarters
 - Hotel Rooms
 - Open Space Acres
 - Enrollment

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	lu_code	LU Description	MGRA	Dwelling Unit	Share Affordable	Acre	Employee	Thousand Square Feet (KSF)	Hotel Rooms	Beds	Students	Pumps	Spaces	Seats
3	101	Single Family Residential												
4	102	Multi-Family Residential												
5	103	Mobile Home Park												
6	1401	Jail/Prison												
7	1402	Dormitory												
8	1403	Military Barracks												
9	1409	Other Group Quarters Facility												
10	1501	Hotel (Low-Rise)												
11	1502	Hotel (High-Rise)												
12	1503	Resort												
13	2001	Heavy Industry												
14	2101	Industrial Park												
15	2103	Light Industry - General												
16	2104	Warehousing												

Project Data | Project Summary | Project_Data_Example | HotelRoomShare | ...



2. Land Use Converter - Employment

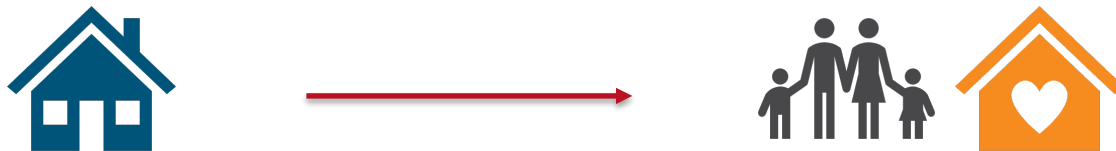
Converts non-residential supply to employment based on employment densities, priorities and sub-types.

INPUT DATA	DESCRIPTION
Employment Densities	Newly estimated employment densities by land use code.
Density Priorities	Priority order of densities to be used for each land use type
Employment Shares by Sub-type	Allocation of employment by sub-type



2. Land Use Converter - Households

- Converts household dwelling units to households based on existing occupancy rates.
 - Region specific
 - Unit type specific
- Group Quarters are assumed to have 100% occupancy per number of beds specified.



2. Land Use Converter - Hotel Rooms

Hotel room subtype applies an input ratio by land-use type.

	A	B	C	D	E	F	G	H	I
1	lu_code	DESC	budgetroom	economyroom	luxuryroom	midpricerroom	upscaleroom	hotelroomtotal	
2	1501	Hotel / Motel (Low Rise)	0.14	0.16	0.09	0.42	0.19	1	
3	1502	Hotel / Motel (High Rise)	-	0.01	0.60	0.03	0.35	1	
4	1503	Resort	-	0.01	0.74	0.07	0.18	1	
5									

HotelRoomShare

Land Use Descriptions

+

Ready Accessibility: Investigate Display Settings

2. Land Use Converter - Open Space Acres

Acres for active park, open space/preserve, and active beach are updated based on the land-use type.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	parkactive_lu	openspaceparkpreserve_lu	beachactive_lu	hotel_lu	sf_lu	mf_lu	mh_lu	k8	hsch	coll	oth_coll	adlt_enrl	zeroden_lu	gq_civ_lu	gq_mil_lu
2	7601	7603	7604	1501	101	102	103	6806	6804	6801	6802	6809	4112	1401	1403
3	7691	7693		1502				6805	6894	6891	6803	6899	4117	1402	
4				1503				6896			6893		4118	1409	
5				1504				6895			6892			1404	
6				1592										1499	
7				1599										1410	
8														1411	
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															

Unit Type Correlation

Densities

Allocation

LU Correspondence

2. Land Use Converter – School Enrollment

Enrollment is directly updated by students and land-use type.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	parkactive_lu	openspaceparkpreserve_lu	beachactive_lu	hotel_lu	sf_lu	mf_lu	mh_lu	k8	hsch	coll	oth_coll	adlt_enrl	zeroden_lu	gq_civ_lu	gq_mil_lu
2	7601	7603	7604	1501	101	102	103	6806	6804	6801	6802	6809	4112	1401	1403
3	7691	7693		1502				6805	6894	6891	6803	6899	4117	1402	
4				1503				6896			6893		4118	1409	
5				1504				6895			6892			1404	
6				1592										1499	
7				1599										1410	
8														1411	
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															

Unit Type Correlation | Densities | Allocation | **LU Correspondence** | +



2. Land Use Converter - Land Use Overrides

- User chooses to overwrite or append new land use.
 - “OVERRIDE_HH” – households and group quarters
 - “OVERRIDE_EMP” – employment categories
 - “OVERRIDE_LU” – hotels, open space, enrollment



3. PopulationSim Repop - Controls

- PopulationSim Repop feature synthesizes new population in proposed development.
 - Creates stability outside of the project area.
- Controls are built from existing population.

Population Controls

TARGET	DESCRIPTION
Total Households	Total number of households
Size	Household by Size
# Workers	Household by # Workers
Unit Type	Single-Family/Multi-Family/Affordable
Age	Population by Age Category

Group Quarter Controls

TARGET	DESCRIPTION
Total group Quarters	Total Number of Group Quarter Population
Age	Population by Age Category



3. PopulationSim Repop - Control Sampling

- Geographic sampling for controls – threshold for TAZ and households.
- Override geographic sampling by providing zone list.



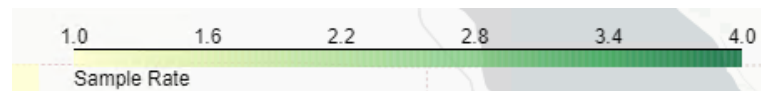
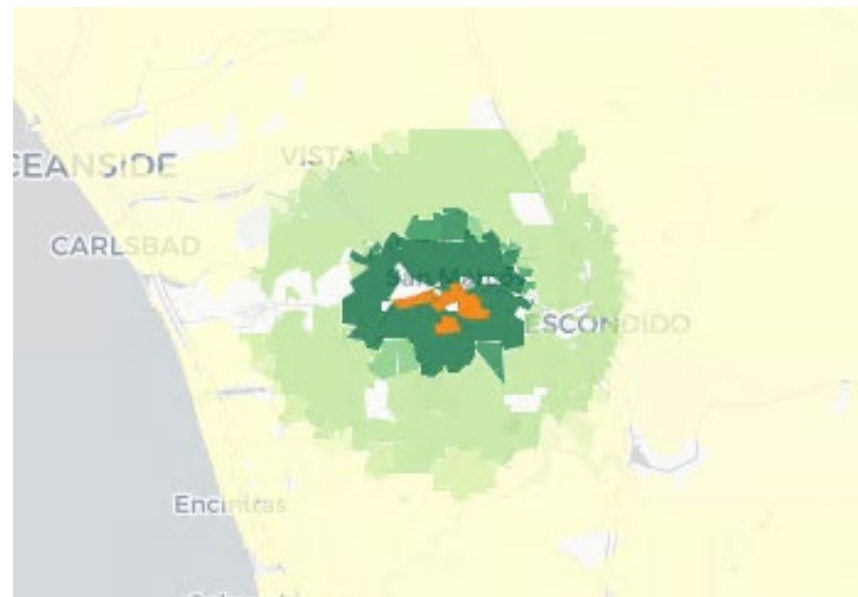
4. Land Use Update

- After the new synthetic population is generated, the land use inputs are updated.
 - Total population
 - Households by income category
- If housing is removed from land use, it is also removed from the synthetic population.



5. Household Sampling

- Oversamples households in and near the project.
 - User settings to control buffer distances and sample rates
 - Allow for 2 buffer distances and 3 sample rates
- Purpose is to reduce variability in model results.



6. Copy Files to Model Directory

- Updates files in model directory.
- Saves intermediate files to scenario model folder.
- Preserves original model inputs.

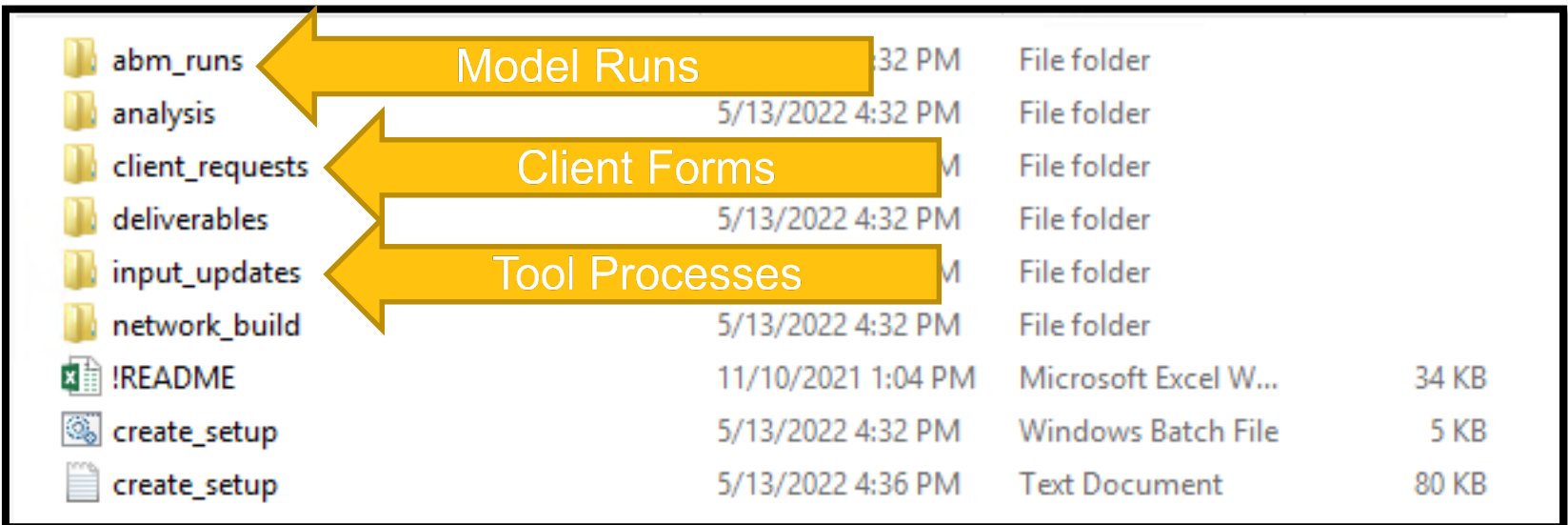




User Workflow

Create Workspace – One Click Set Up

- Tool and software packages are centrally located with the official model release and integrated with existing setup.
- Batch file is used to setup project workspace.



abm_runs	5/13/2022 4:32 PM	File folder	
analysis	5/13/2022 4:32 PM	File folder	
client_requests	5/13/2022 4:32 PM	File folder	
deliverables	5/13/2022 4:32 PM	File folder	
input_updates	5/13/2022 4:32 PM	File folder	
network_build	5/13/2022 4:32 PM	File folder	
!README	11/10/2021 1:04 PM	Microsoft Excel W...	34 KB
create_setup	5/13/2022 4:32 PM	Windows Batch File	5 KB
create_setup	5/13/2022 4:36 PM	Text Document	80 KB

Configure Scenario Settings

- Work with clients to configure model input settings.
 - Land use overrides.
 - Synthetic population control sampling settings.
 - Household sampling buffers and rates.

```
::~~~~~  
:: 02 Land Use Converter  
::   This tool updates the MGRA land use file according to the project  
::  
:: Settings  
::   OVERRIDE_HH:  
::     Set as YES to override existing land use in project MGRA.  
::     Set as NO to keep existing land use in project MGRA and append project land use.  
::  
::   OVERRIDE_EMP:  
::     Set as YES to override existing land use in project MGRA.  
::     Set as NO to keep existing land use in project MGRA and append project land use.  
::  
::   OVERRIDE_LU:  
::     Set as YES to override existing land use in project MGRA.  
::     Set as NO to keep existing land use in project MGRA and append project land use.  
::  
::   BUFFER:  
::     Buffer distance in miles for calculating household and employment densities.  
::     This distance should remain consistent with the 4D tool.  
::~~~~~  
SET OVERRIDE_HH=YES  
SET OVERRIDE_EMP=YES  
SET OVERRIDE_LU=YES  
SET BUFFER=0.65
```



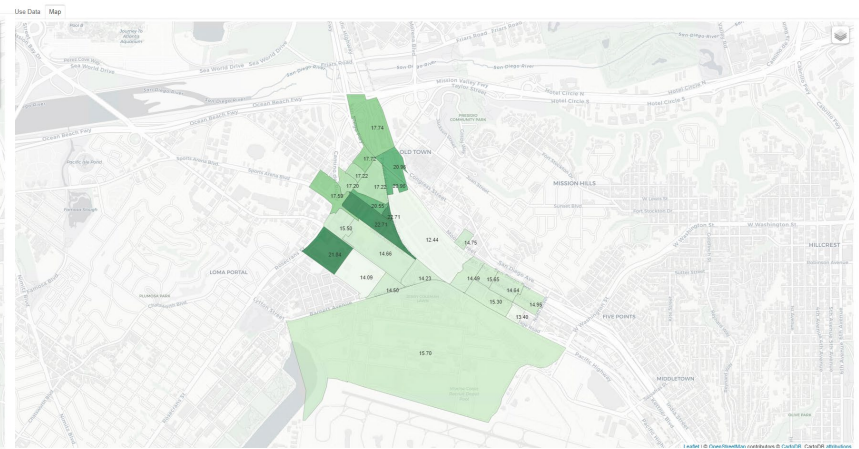
Run the Application Tool

- Batch file runs all application tool processes together.
 - Each step can be run alone or disabled.
- Built-in reasonableness checks for red-flag issues.
- Logging to report decisions.
 - Occupancy rates.
 - Household control sample size.
- Interactive maps for geospatial QA/QC.



Run the Application Tool – QA/QC

Interactive maps help visualize project land use changes including new household and employment densities.



Run the Application Tool – QA/QC

Land Use Change Table

Land Use Data

Map

No Build Land Use Inputs

MGRA	Households	Single-Family Households	Multi-Family Households	Affordable Multi-Family Households Share	Mobile Home Households	Open Space Acres	Employment
6190	2	2	0	0	0	6	387
Total	2	2	0	0	0	6	387

Build Land Use Inputs

MGRA	Households	Single-Family Households	Multi-Family Households	Affordable Multi-Family Households Share	Mobile Home Households	Open Space Acres	Employment
6190	0	0	0	0.00	0	0	595
Total	0	0	0	0.00	0	0	595

Change in Land Use Inputs

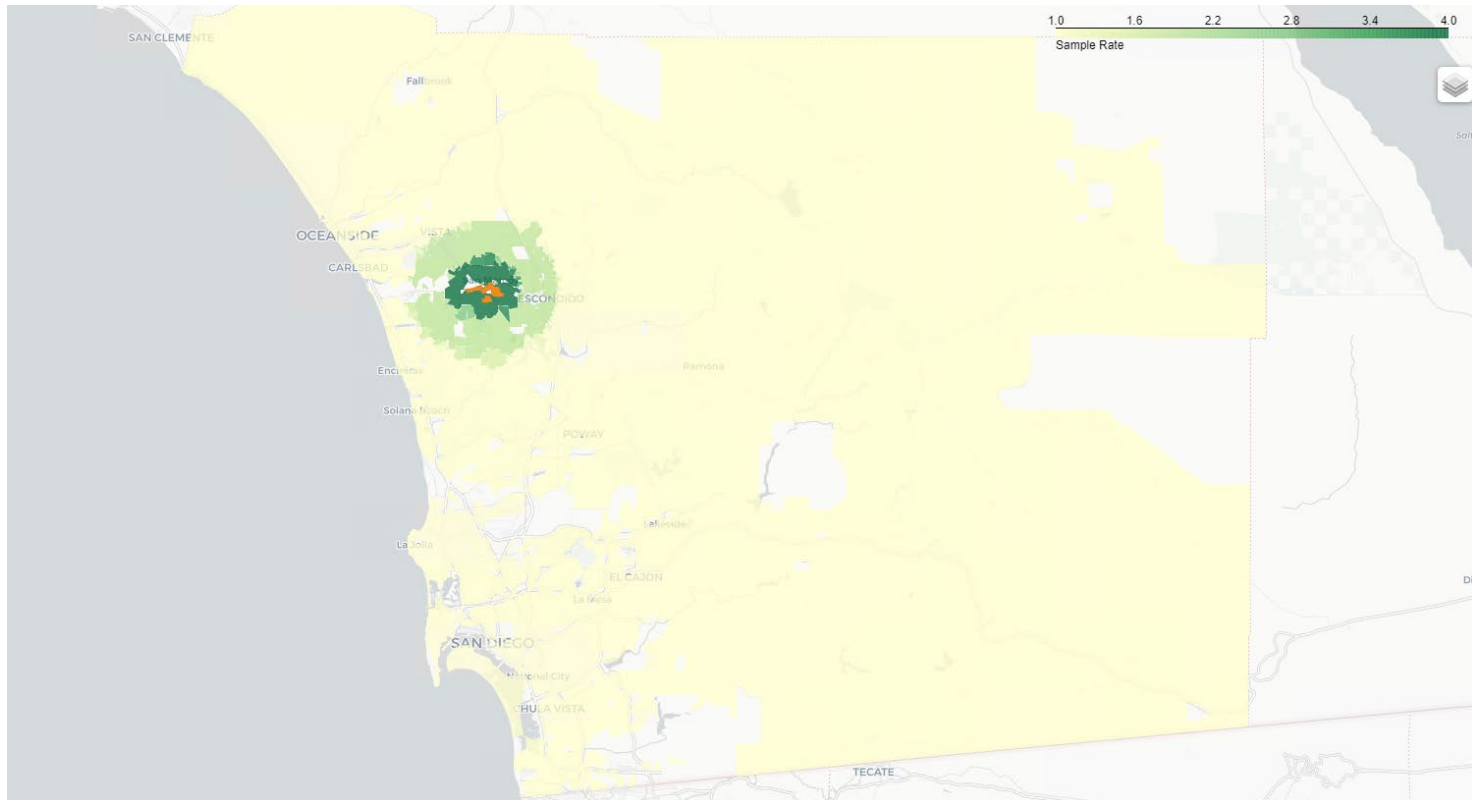
MGRA	Households	Single-Family Households	Multi-Family Households	Affordable Multi-Family Households Share	Mobile Home Households	Open Space Acres	Employment
6190	-2	-2	0	0.00	0	-6	208
Total	-2	-2	0	0.00	0	-6	208

No Build Land Use Overridden in ['Households', 'Single-Family Households', 'Open Space Acres', 'Enrollment']



Run the Application Tool – QA/QC

Interactive maps also visualize household sampling geography.



Run the Application Tool

- Ready to run your scenario!
- Same workspace can be used to create the next scenario.





Summary

To Summarize

- Automated land use conversions to produce model inputs.
- Implemented population synthesizer for the additional population.
- Implemented household sampling to improve model stability.
- Created a standardized workflow for Service Bureau applications work.
- Delivered a Final Report, a User's Guide and a Workshop.



What We Love

- Client interface made project communications easier.
- The tool is packaged together neatly running from a single location.
- The user experience was highly considered during the development process.
- If given infinite time and money.....





RSG

the science of insight

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Employment Densities

- Square feet per employee calculations
- Acreage per employee calculations
- Non-standard use calculations

DATASET	SOURCE	TYPE	USE
CA EDD	SANDAG	Spatial Point	2019 Quarter 3 Employment
Land Use Parcel	SANDAG	Spatial Polygon	Parcel Level Land Use and Shape
CoStar	CoStar	Spatial Point	Building Area
Building Outline	SANGIS	Spatial Polygon	Building Footprint Area
Colleges	SANGIS	Spatial Point	College Location
Schools	SANGIS	Spatial Point	School Location
K-12 Enrollment	NCES	CSV	K-12 Enrollment by school
College Enrollment	IPEDS	CSV	College/University Enrollment by School

