

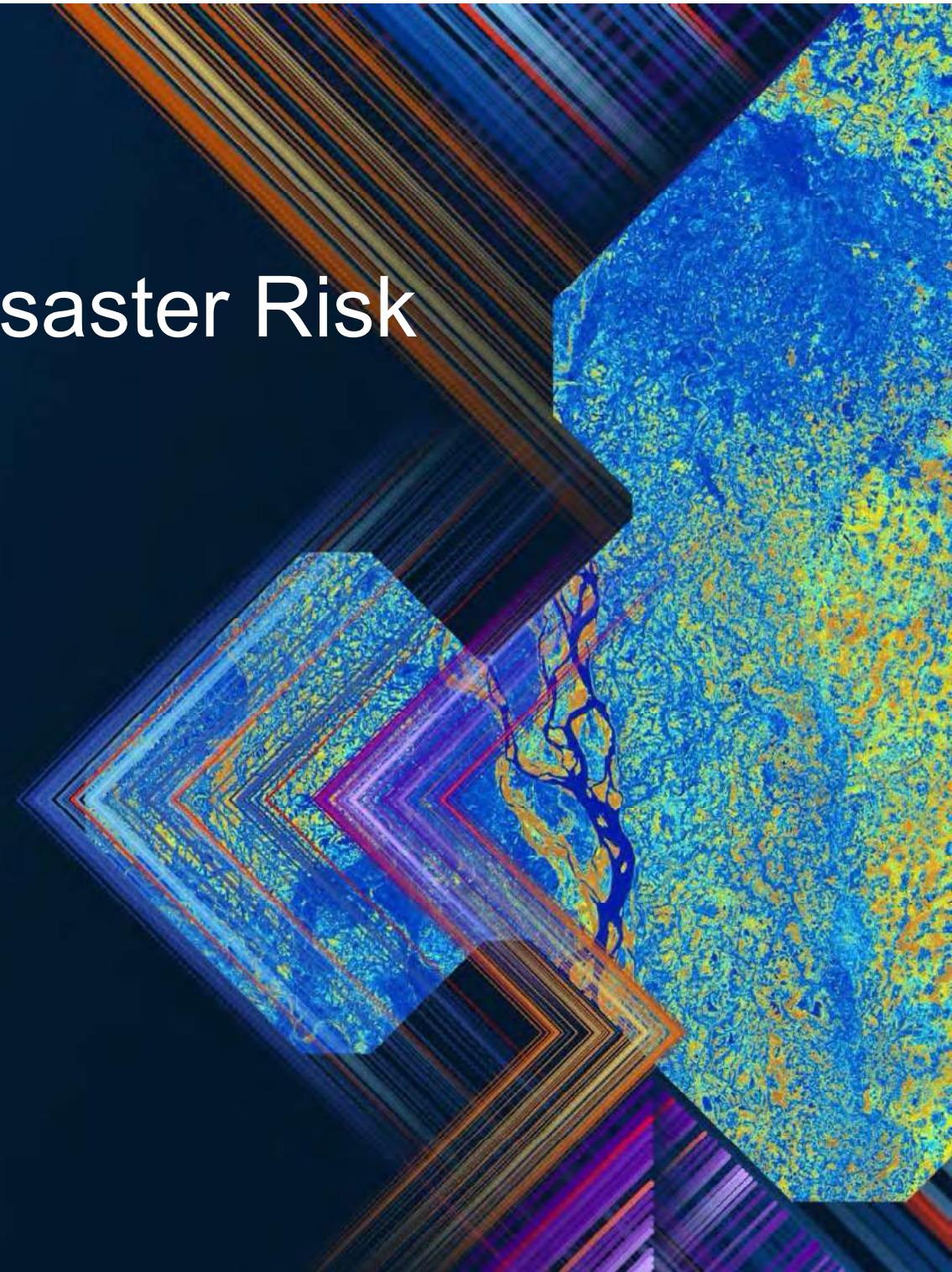
# Saving Lives through better Disaster Risk Monitoring and Mitigation

## uMngeni-uThukela Water: Disaster Risk Encroachment Solution (DRES)

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*SOUTHERN AFRICA ESRI USER CONFERENCE 2025*





# Introduction

- What is servitude encroachment?

**Servitude encroachment** happens when unauthorized or illegal structures are constructed on land reserved for public or private infrastructure, such as pipelines, roads, or utility lines.

- What are the challenges associated with encroachment?

- Restricted access for maintenance and operations teams
- Increased safety risks
- Potential legal and financial consequences
- Interruptions to normal operations
- Strained relationships with the local community





# Surveillance and Early Detection

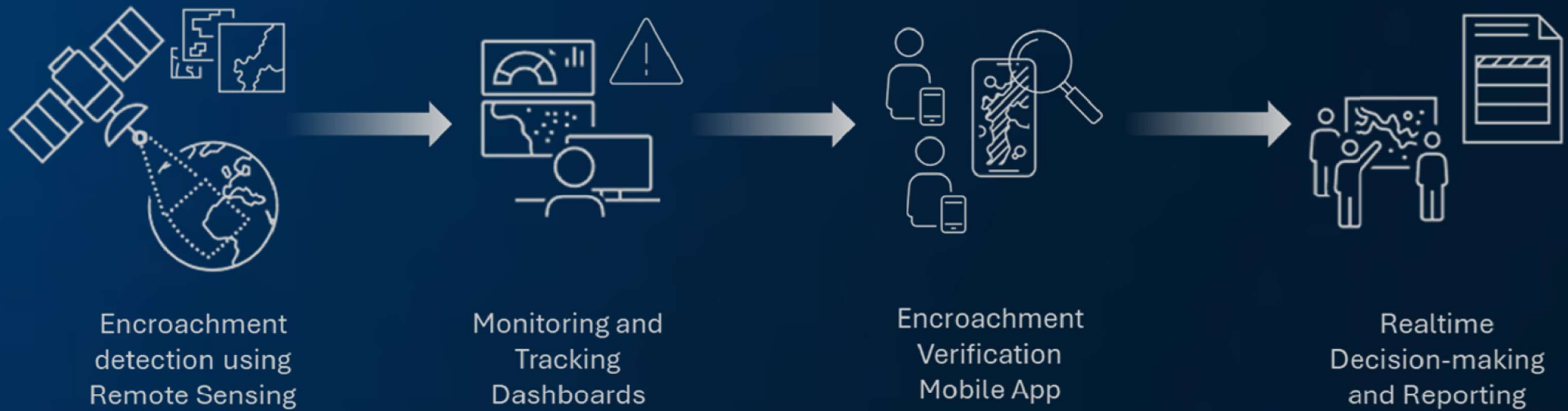
- Satellite-based monitoring and change detection  
Using **satellite and mapping technology** enables early detection of servitude encroachments, reducing risks to critical infrastructure. Automated, regular surveillance alerts companies to new unauthorized structures promptly, allowing quick intervention.
- Efficient, reliable and cost-effective  
High-resolution imagery, change detection, and GIS analysis ensure precise tracking. Centralized platforms provide real-time data for better decision-making.





# uMngeni – uThukela Water: DRES

## Disaster Risk Encroachment Solution

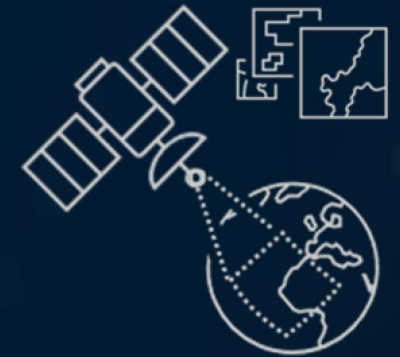




# uMngeni – uThukela Water: DRES

## Planet and CGIS: Encroachment Detection

- The application leverages Planet's daily global imagery and machine learning models to:
  - Identify new buildings and other significant changes with weekly updates.
  - Aggregate and analyze time-series data for change detection.
  - Provide actionable insights through APIs and visualization tools.



Encroachment  
detection using  
Remote Sensing

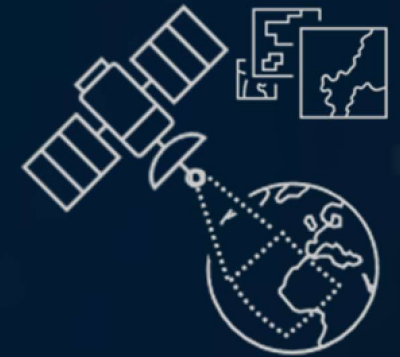


# uMngeni – uThukela Water: DRES

## Planet and CGIS: Encroachment Detection

- Data Processing Workflow

- a) Data Ingestion:* PlanetScope imagery is acquired daily.
- b) Segmentation:* U-Net model processes each image to classify pixels.
- c) Aggregation:* Daily results are combined into weekly layers.
- d) Change Detection:* Time-series models flag deviations.
- e) Output:* GeoJSON files are delivered via API.
- f) Publishing:* GeoJSON converted into ESRI online feature layers via ArcGIS Pro
- g) Ground-Truthing:* Features pushed onto survey123 for field verification.
- h) Interfacing:* ArcGIS Dashboards to visualise change events to date and monitor verification progress.



Encroachment  
detection using  
Remote Sensing

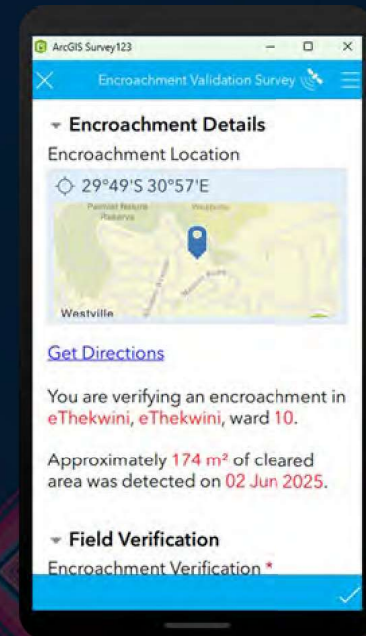
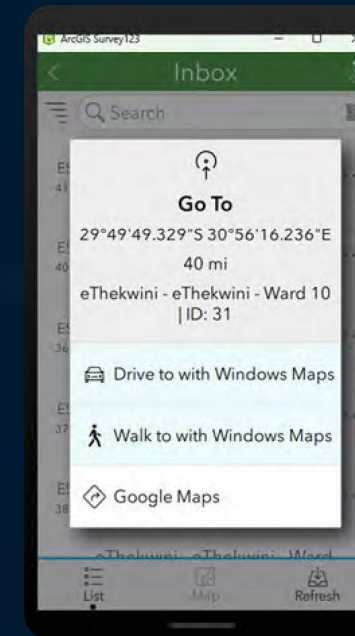
# uMngeni – uThukela Water: DRES

## Operations & Security Teams: Verification & Feedback

- The Field Worker survey is built on the machine learning output feature layer and is configured to deliver points into the inboxes of designated named users, enabling each detection to be reviewed and verified.
- Users complete the survey by answering a set of structured questions, confirming whether the detection represents valid encroachment activity and classifying its type.
- Once submitted, the status of the point is updated in the feature layer, and the record is automatically removed from the user's Inbox, ensuring that only unverified events remain available for action.



Encroachment  
Verification  
Mobile App

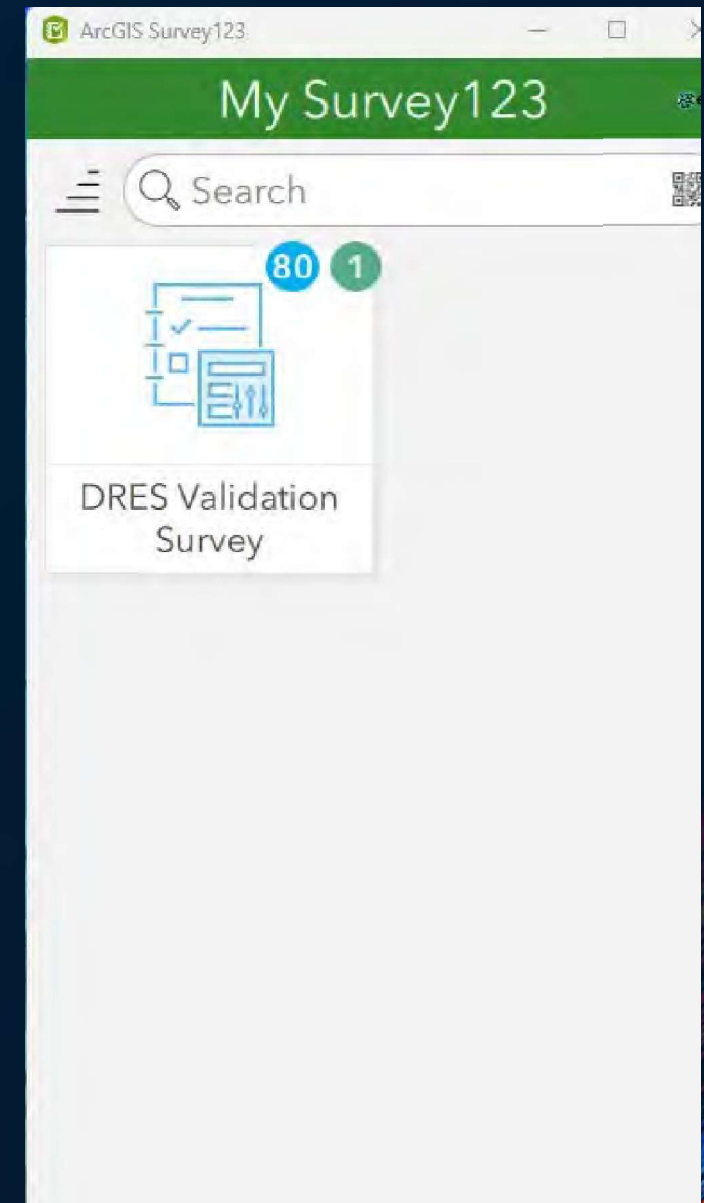




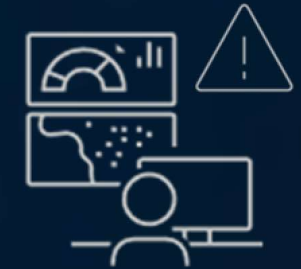
# uMngeni – uThukela Water: DRES

## Survey DEMO

- ArcGIS Survey123
- Inbox Function – allocate to specific teams/field workers who log in using username/password (Security and Traceability)
- Remote/Offline capability
- Directions from current location to encroachment event
- Automatic Date/Time/Location/User capture
- Live updates to Monitoring Dashboards as they are captured





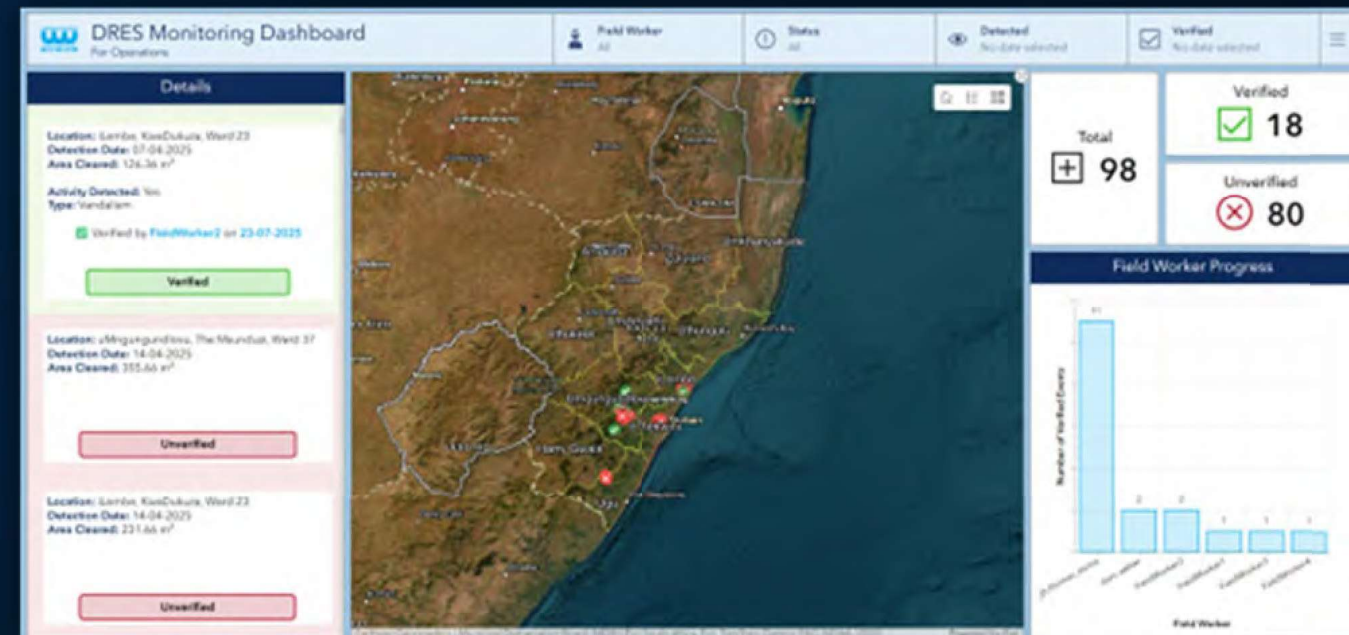


# uMngeni – uThukela Water: DRES

## UUW CGIS: Monitoring and Tracking

- The solution consists of two dashboards: one designed for Operations and another for Managers, providing UUW with real-time oversight of potential encroachment detections and field verification activities.
- Through spatial mapping, event status tracking, and fieldworker performance monitoring, the dashboards deliver a clear and accountable view of progress, validation, and activity trends.
- This ensures that Operations teams can manage day-to-day verifications while Managers can monitor high-risk areas, track outcomes, and drive timely action to address encroachments.

Monitoring and  
Tracking  
Dashboards



# uMngeni – uThukela Water: DRES

## UUW CGIS: Reporting (DEMO)

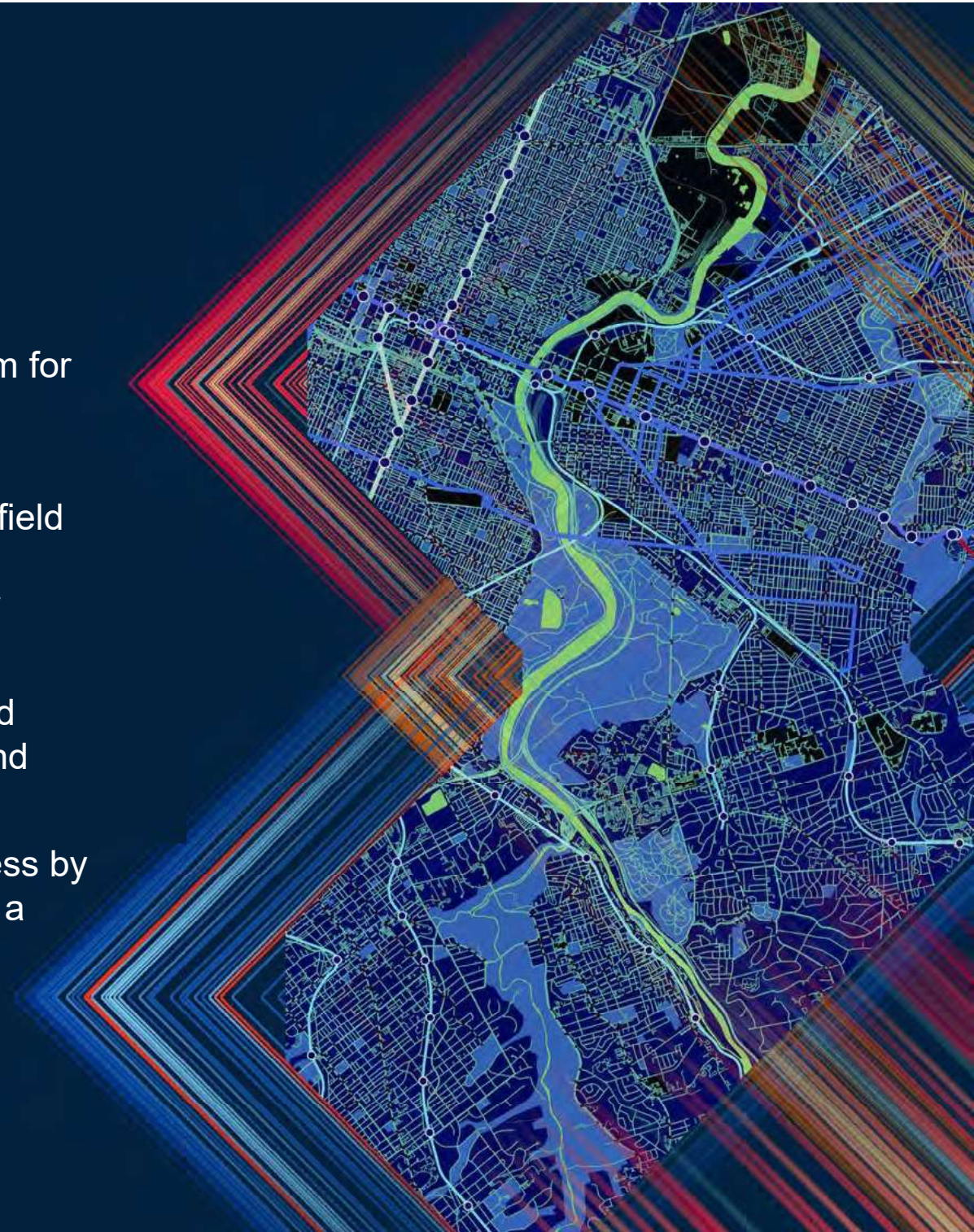


Realtime  
Decision-making  
and Reporting



# Conclusion

- The solution provides Uuw with an integrated and scalable platform for detecting, verifying, and managing encroachment risks across its operational areas.
- By combining automated machine learning outputs with structured field verification through Survey123, the solution ensures that potential encroachments are identified accurately and acted upon in a timely manner.
- The use of ArcGIS Dashboards enables both operational teams and management to maintain real-time oversight, track performance, and analyze activity trends for improved decision-making.
- The central Experience Builder application further streamlines access by consolidating dashboards, surveys, and organizational context into a single, role-based interface.







*“Through this end-to-end workflow, DRES strengthens UUW’s ability to safeguard its bulk water infrastructure by providing accountability, transparency, and actionable insights. The solution not only enhances operational efficiency but also establishes a sustainable monitoring framework that supports both immediate field interventions and long-term strategic planning”.*



**Thank You**

**Any Questions?**



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