Beneficial Use of CCP & Its Role in Impoundment Closures

WPCA/TVA Ash Pond Seminar

Oak Ridge, TN

Sept 18, 2019

Agenda

- CCP Impoundment Closure Options
- CCP Harvesting for Beneficial Use
- Key Considerations
- Path Forward
- Case Study

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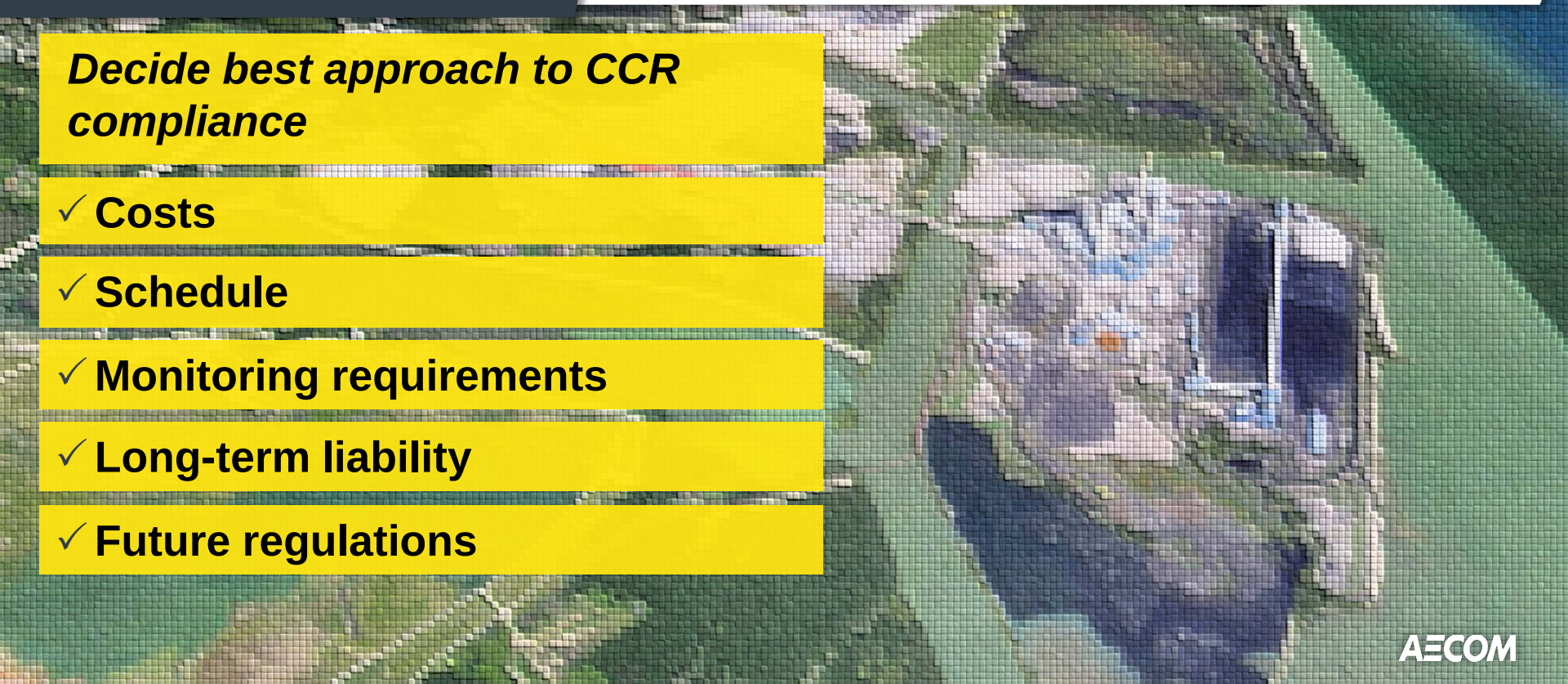
CCP Impoundment

PROBLEM

Closure triggers are upon us…



Decide best approach to CCR compliance

- ✓ **Costs**
- ✓ **Schedule**
- ✓ **Monitoring requirements**
- ✓ **Long-term liability**
- ✓ **Future regulations**

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Closure of CCP Surface Impoundments

ALTERNATIVES

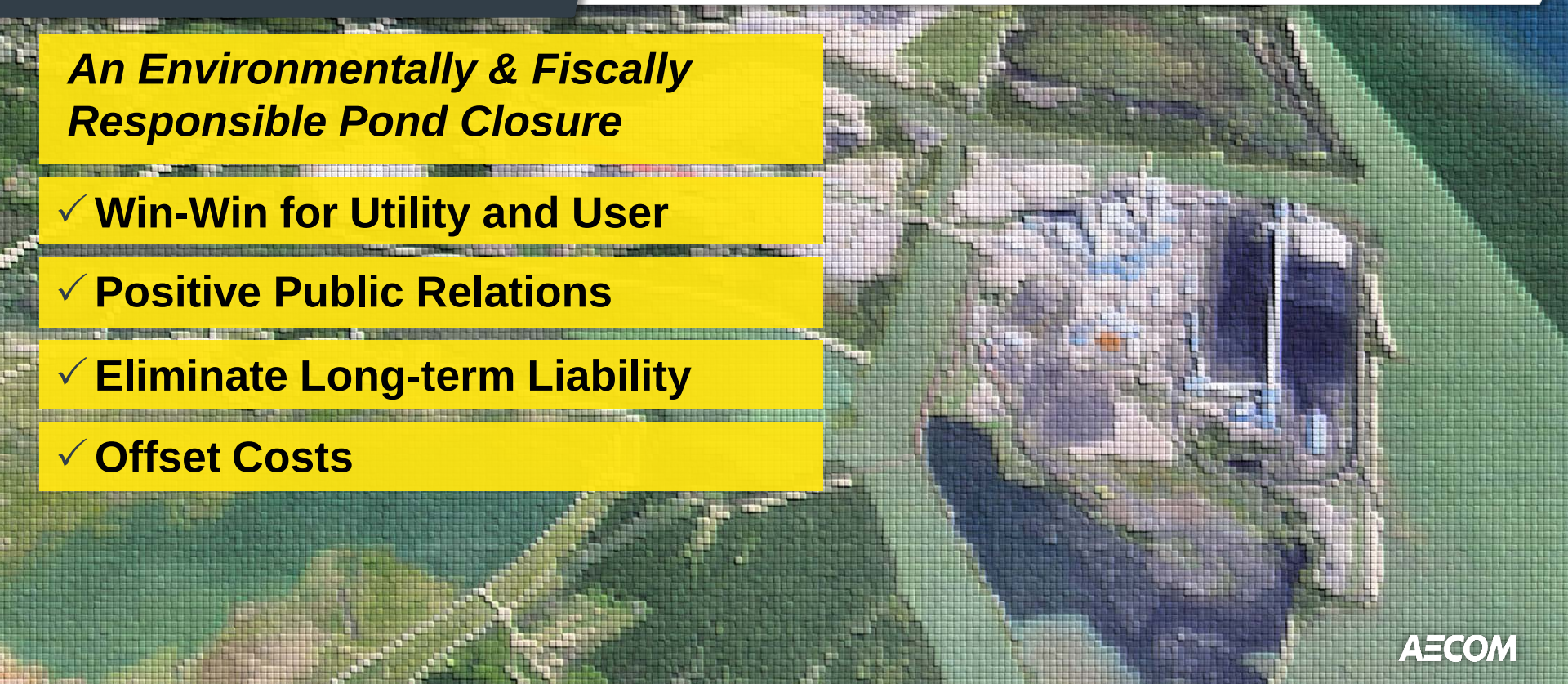
1 CLOSURE BY REMOVAL

2 CLOSE IN PLACE

Closure by Removal

SOLUTION

CBR + Beneficial Use of Pond Ash



An Environmentally & Fiscally Responsible Pond Closure

- ✓ **Win-Win for Utility and User**
- ✓ **Positive Public Relations**
- ✓ **Eliminate Long-term Liability**
- ✓ **Offset Costs**

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Harvesting & Beneficial Use

KEY CONSIDERATIONS

- QUANTITY OF MATERIAL
  How much?
- QUALITY OF MATERIAL
  Is it useable? Can it be made usable?
- HISTORY OF MATERIAL
  Variability? Precedence?
- LOGISTICS
  Local / regional users, transportation options
- VALUE
  vs disposal

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Typical Path Forward

STEPS

SAMPLING & ANALYSIS PLAN (SAP)

3D MODEL QUANTITY / QUALITY

ENGAGE BENEFICIAL USER

INFRASTRUCTURE FEED & CLASS-3 ESTIMATE

INTEGRATE INTO COURSE PLAN

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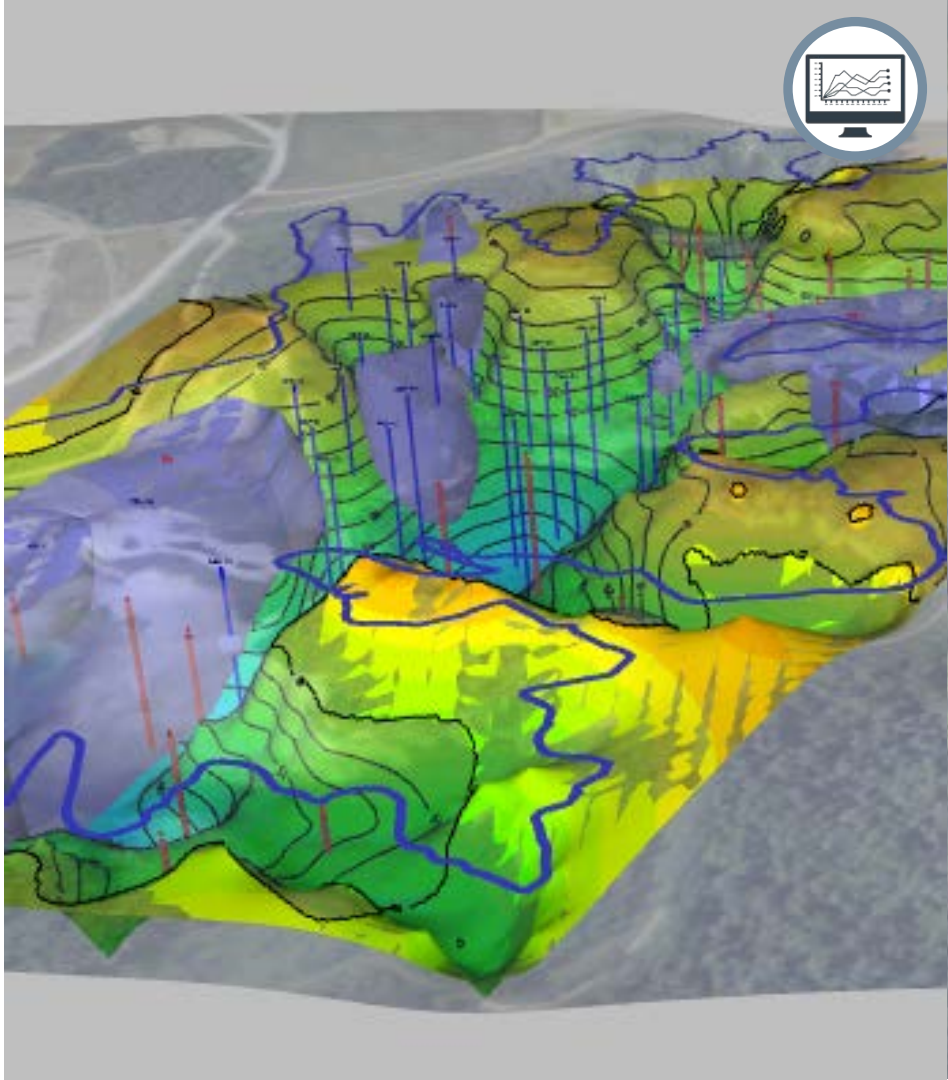
Sampling & Analysis Plan

KEY STEPS

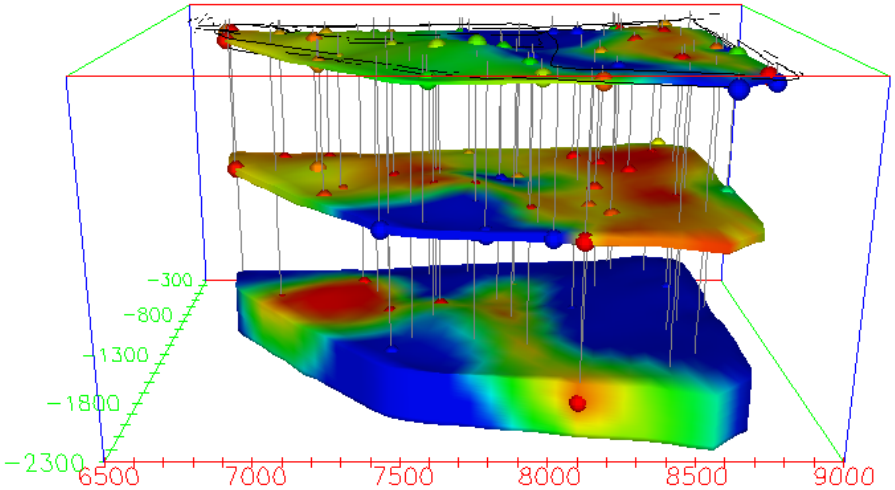
1. DEVELOP & EXECUTE A SAMPLING AND ANALYSIS PLAN FOCUSED ON CONSTITUENTS OF IMPORTANCE (E.G., LOI, HG, SO_3^{-2}, ETC.)
2. SAMPLE ALONG THE LENGTH OF EACH BORING
3. ANALYZE & QC RESULTS
4. PREPARE DATA FOR INPUT IN 3D MODEL

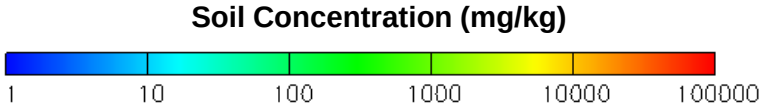


3D Modeling

ENVIRONMENTAL VISUALIZATION SYSTEM (EVS)

- 3D VISUALIZATION & ANIMATION PACKAGE
- USED IN GROUNDWATER REMEDIATION TO ILLUSTRATE CONTAMINATION & GEOLOGICAL FORMATIONS
- CREATES 3D MAP OF ENTIRE IMPOUNDMENT
- PERMITS ESTIMATION OF MATERIAL THAT:
  - CAN BE USED AS-IS
  - REQUIRES ADDITIONAL PROCESSING
  - REQUIRES DISPOSAL
- FACILITATES EXCAVATION PLAN THAT MAXIMIZES CCP FOR BENEFICIAL USE





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Engage Beneficial User

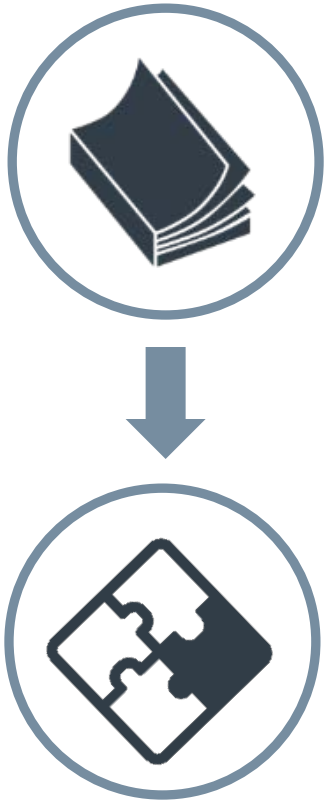
KEY STEPS

1. DETERMINE QUALITY REQUIREMENTS AND ASSOCIATED VALUE
    - *IMPACTED BY SHIPPING REQUIREMENTS (E.G., METHOD, DISTANCE, ETC.)*
2. DETERMINE QUANTITY NEEDS OVER TIME
3. ASSESS NEED FOR ADDITIONAL PROCESSING TO SELL AND/OR AUGMENT CCP VALUE
4. ASSESS LOGISTICS AND ASSOCIATED INFRASTRUCTURE NEEDS TO FACILITATE TRANSPORT OF MATERIAL TO END USER

Economic Assessment

KEY STEPS

1. ESTIMATE THE TOTAL COST OF CBR + BENEFICIAL USE
   - *ACCOUNT FOR INFRASTRUCTURE REQUIREMENTS, TIMING CONSTRAINTS, ADDITIONAL PROCESSING COSTS, VALUE OF CCP, ETC.*
2. COMPARE TO TOTAL COST FOR CIP
   - *CONSIDER MONITORING COSTS, LONG-TERM LIABILITY & POTENTIAL IMPACT OF FUTURE REGULATORY CHANGES*
3. CONSIDER THE PUBLIC RELATIONS ASPECT TO CBR + BENEFICIAL USE
4. DETERMINE BEST APPROACH TO CLOSURE & INTEGRATE INTO COURSE PLAN



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Case Study

KEY CONSIDERATIONS

» QUANTITY OF MATERIAL
Estimated @ 6MM tons

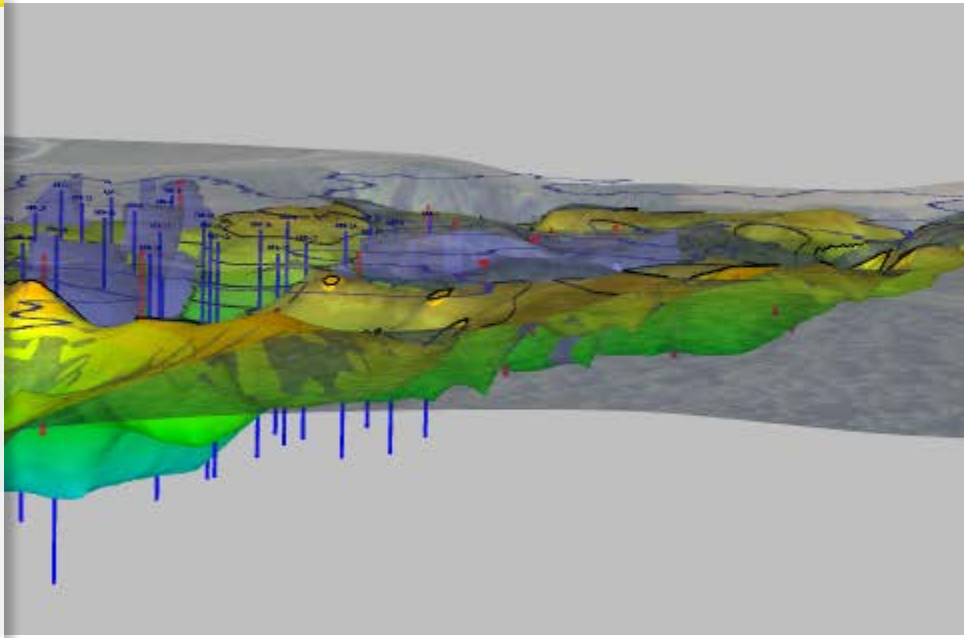
» QUALITY OF MATERIAL
Not fully known

» HISTORY OF MATERIAL
Burned coal from same seam 40+yrs
10+ yrs production ash beneficially used

» LOGISTICS
Cement kiln down river
Limits on amount of ash/year

» OPTIONS CONSIDERED

- **CIP:** $1X MM w/ LT Liability
- **CBR + Landfill:** $2.4X MM w/ LT Liability
- **CBR + BU:** $???



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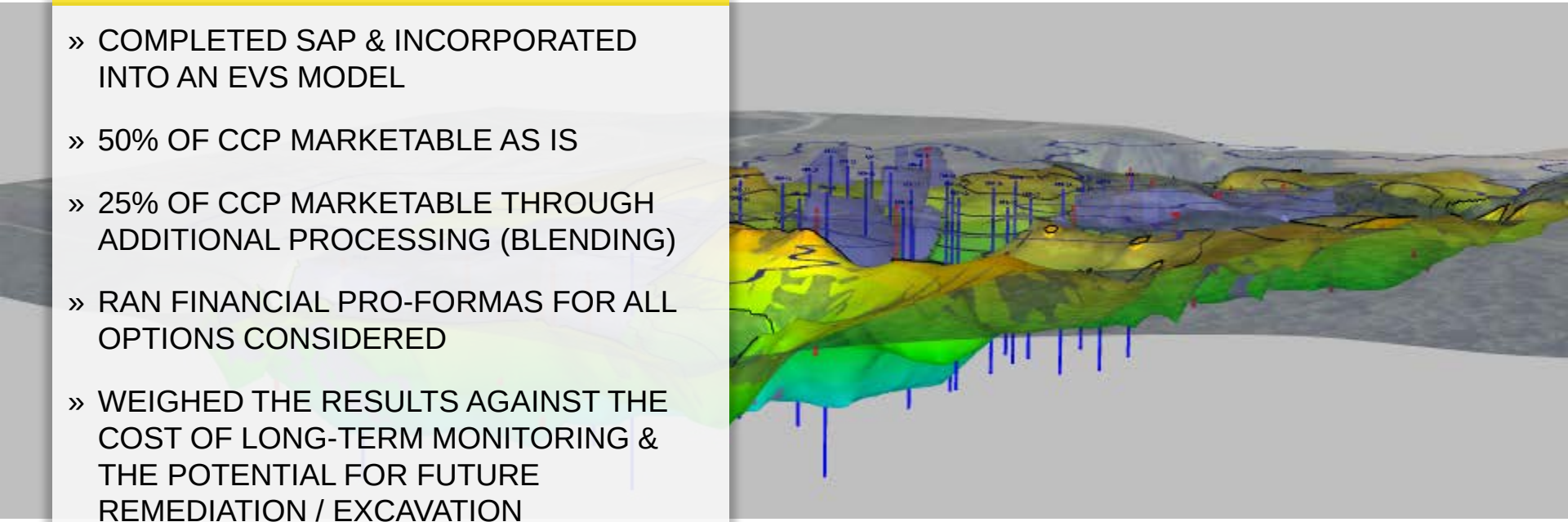
Case Study

DETERMINING QUALITY

- COMPLETED SAP & INCORPORATED INTO AN EVS MODEL
- 50% OF CCP MARKETABLE AS IS
- 25% OF CCP MARKETABLE THROUGH ADDITIONAL PROCESSING (BLENDING)
- RAN FINANCIAL PRO-FORMAS FOR ALL OPTIONS CONSIDERED
- WEIGHED THE RESULTS AGAINST THE COST OF LONG-TERM MONITORING & THE POTENTIAL FOR FUTURE REMEDIATION / EXCAVATION



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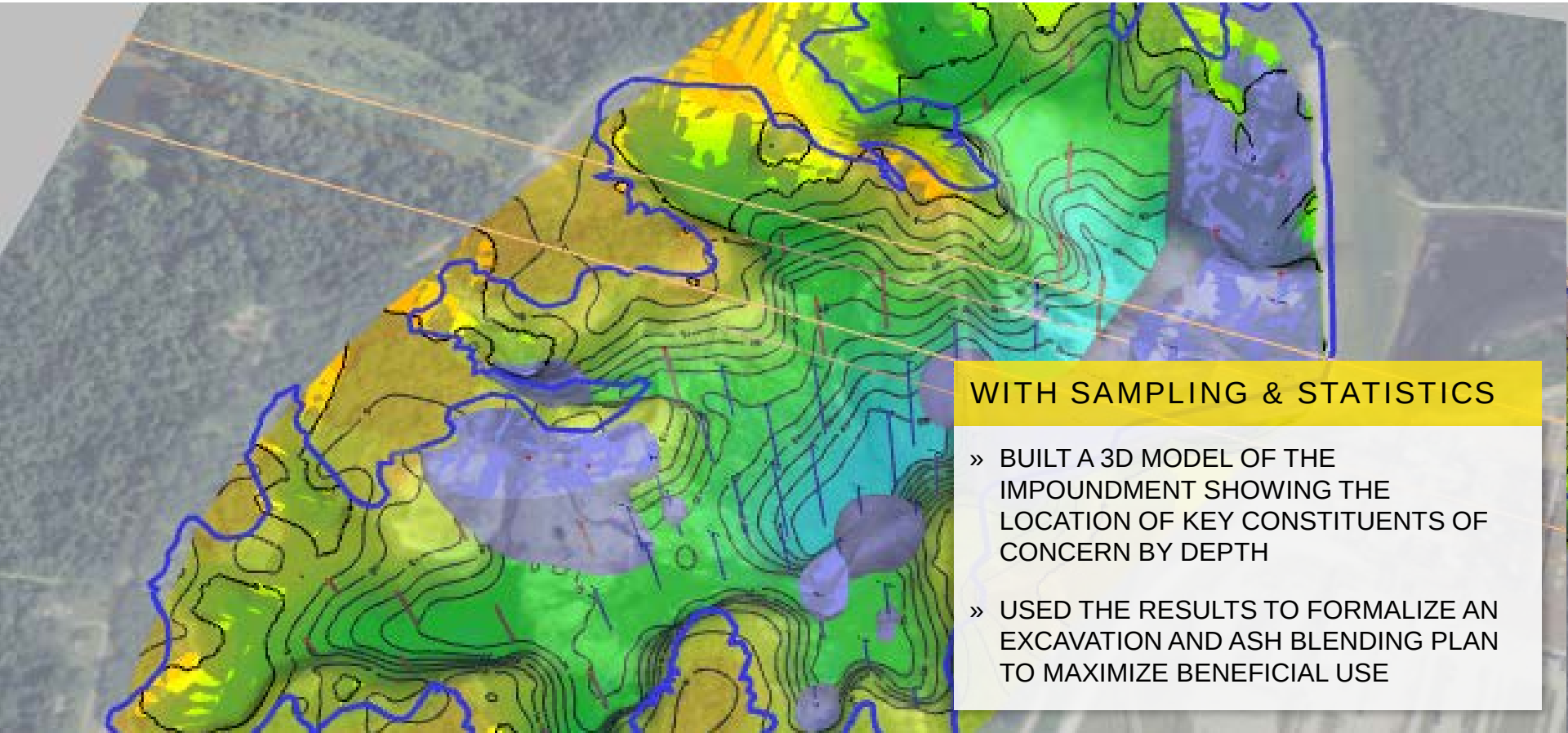
Case Study: Use of EVS to Locate Off-spec Product



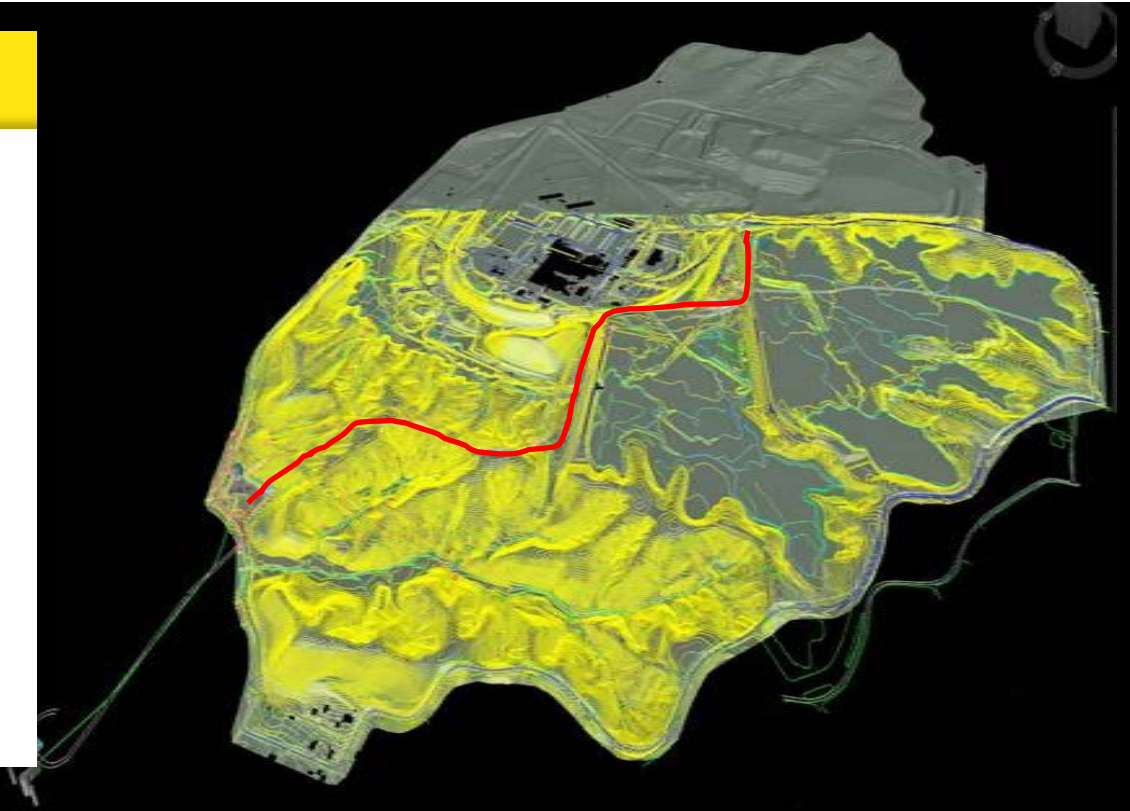
WITH SAMPLING & STATISTICS

- BUILT A 3D MODEL OF THE IMPOUNDMENT SHOWING THE LOCATION OF KEY CONSTITUENTS OF CONCERN BY DEPTH
- USED THE RESULTS TO FORMALIZE AN EXCAVATION AND ASH BLENDING PLAN TO MAXIMIZE BENEFICIAL USE

Case Study

ECONOMIC CONSIDERATIONS

- » PIPE CONVEYOR ROUTING & COST
- » BARGE LOADING UPGRADES
- » ELECTRICAL, INSTRUMENTATION & CONTROLS
- » EXCAVATION & BLENDING STRATEGY
- » EXCAVATION & CLOSURE SCHEDULE & COST
- » PERMITTING AND COMPLIANCE
- » FULL LIFECYCLE START-TO-FINISH



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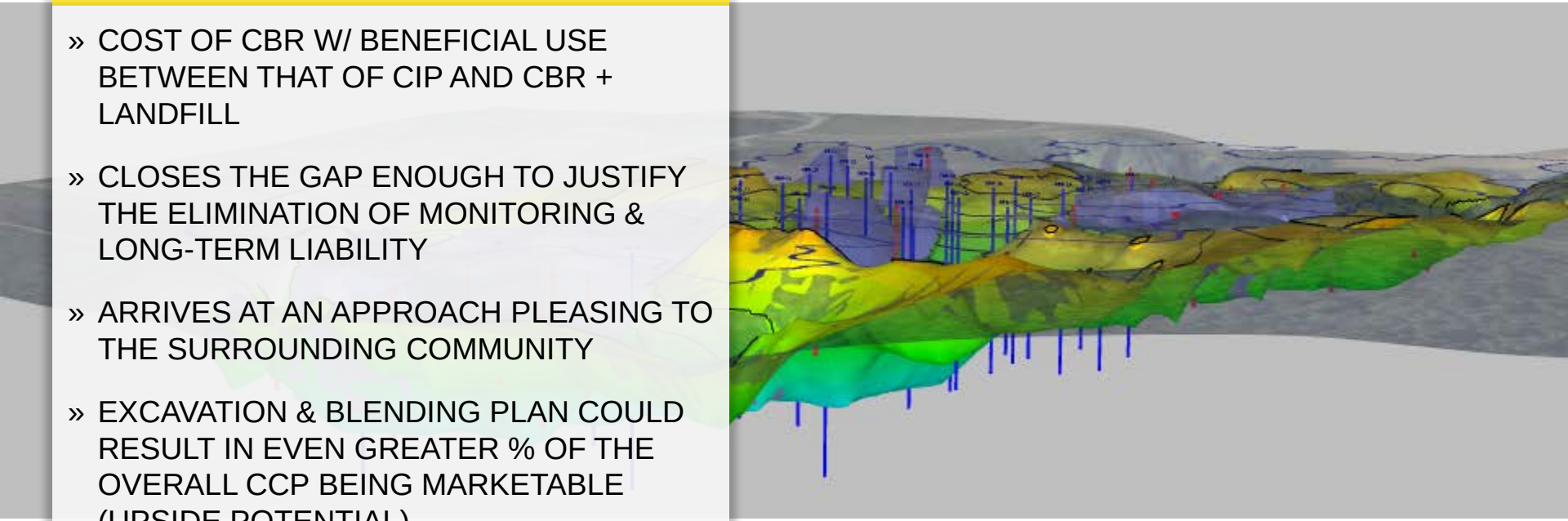
Case Study

FINDINGS

- COST OF CBR W/ BENEFICIAL USE BETWEEN THAT OF CIP AND CBR + LANDFILL
- CLOSES THE GAP ENOUGH TO JUSTIFY THE ELIMINATION OF MONITORING & LONG-TERM LIABILITY
- ARRIVES AT AN APPROACH PLEASING TO THE SURROUNDING COMMUNITY
- EXCAVATION & BLENDING PLAN COULD RESULT IN EVEN GREATER % OF THE OVERALL CCP BEING MARKETABLE (UPSIDE POTENTIAL)



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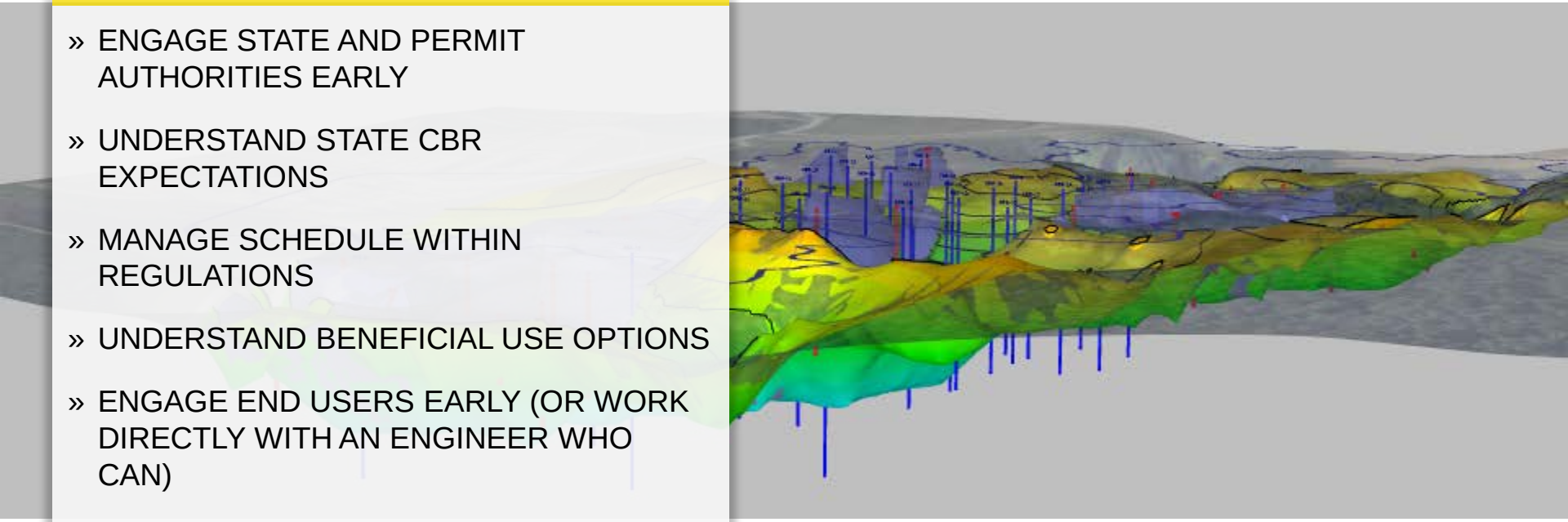
In Closing – Helpful Considerations

LESSONS LEARNED

- ENGAGE STATE AND PERMIT AUTHORITIES EARLY
- UNDERSTAND STATE CBR EXPECTATIONS
- MANAGE SCHEDULE WITHIN REGULATIONS
- UNDERSTAND BENEFICIAL USE OPTIONS
- ENGAGE END USERS EARLY (OR WORK DIRECTLY WITH AN ENGINEER WHO CAN)
    - IT'S A NEGOTIATION – YOU HAVE SOMETHING OF VALUE
- PLAN & PRICE BASED ON END USER



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Thank You