

REINHOLD ENVIRONMENTAL Ltd.



**2014 NO_x-Combustion Round Table
& Expo Presentations**

February 10 & 11, 2014, in Charlotte, NC / Hosted by Duke Energy

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Greatest Challenges to Effective CCR Management



Presentation to Reinhold Conference

Presented by:

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Project Manager, Geotechnical Engineer

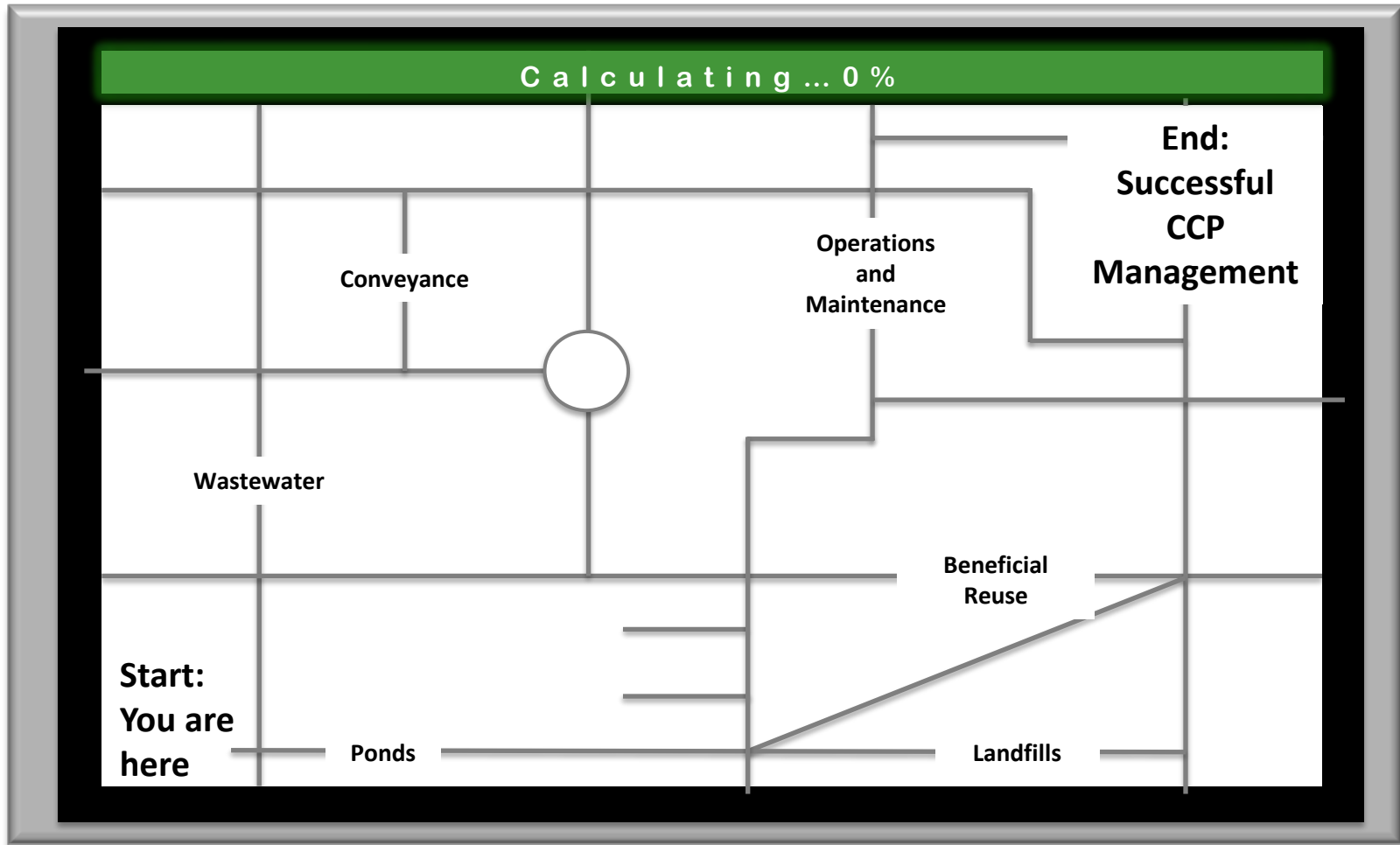
February 10, 2014



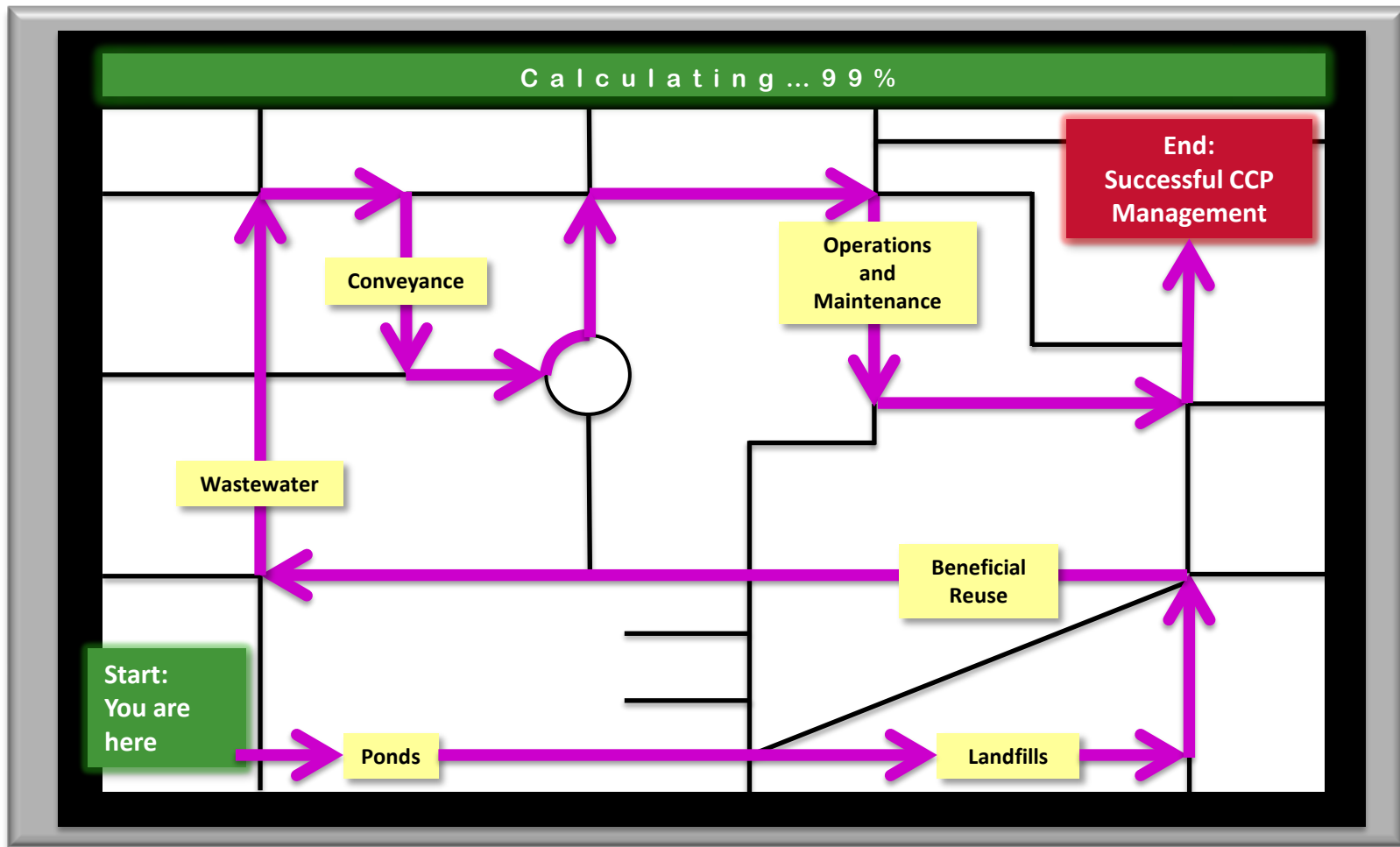
Overall Challenges of CCR Management



Managing CCP in today's market is not easy to map!

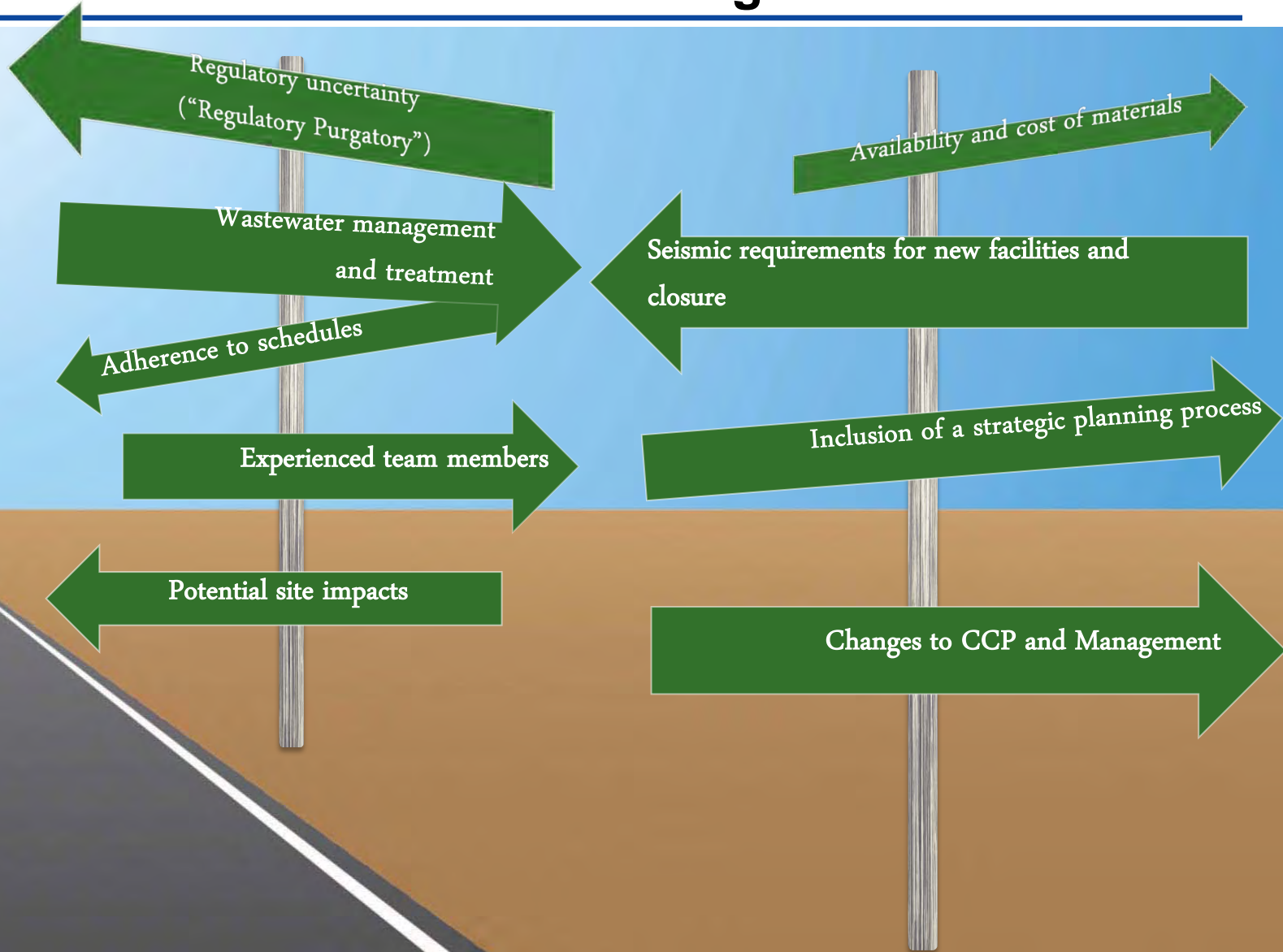


Managing CCP in today's market is not easy to map!

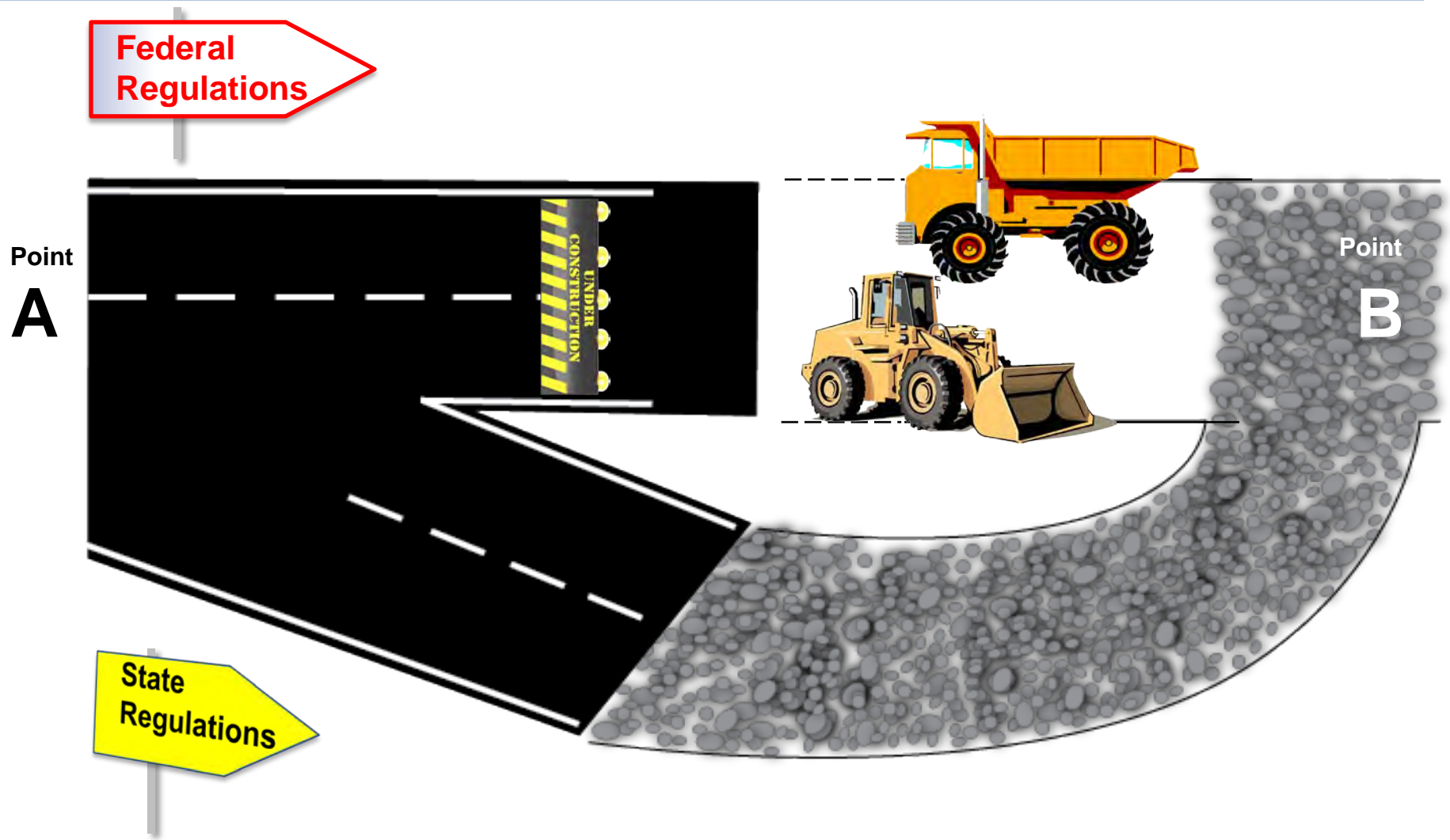


Presentation objective: Identify the challenges and suggest guidance to navigate the route to successful CCP management.

Highest Risks/Concerns in CCP Management



Regulatory Uncertainty (“Regulatory Purgatory”)



Regulatory Uncertainty (“Regulatory Purgatory”)

Where are we now for final federal CCR rules?

Early 2012 – Lisa Jackson assures that the EPA intends to finalize the rule in late 2012 (after completing a risk analysis of coal ash reuse in products)

January 18, 2012 – A coalition of 11 environmentalist groups announce their intent on suing the EPA (They argue that the EPA is ignoring a RCRA requirement to periodically review and revise its waste rules).

April 5, 2012 – The coalition filed the lawsuit to compel the U.S. Environmental Protection Agency (EPA) to regulate coal ash.

October 2012 - Suzanne Rudzinski Declaration (additional time to complete the CCR regulations...1 year...is needed)

September 30, 2013 – Court order to lawsuit says EPA has failed to review CCR Regulations as required (EPA had already agreed with this). EPA to provide a date for final rule.

January 29, 2013 – US EPA announces they will complete the CCR Rules by December 19, 2014

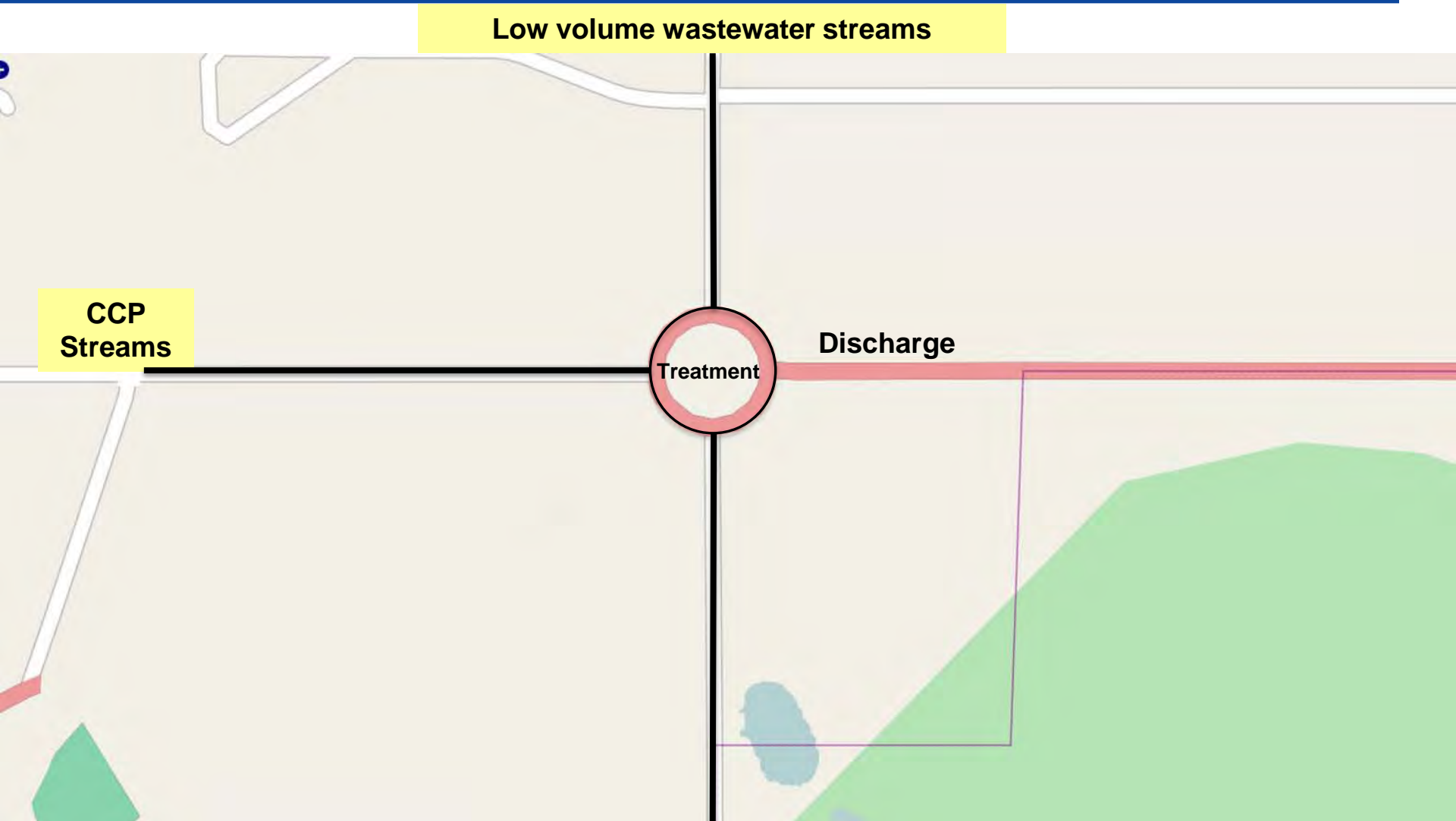
December 19, 2014 !

Regulatory Uncertainty (“Regulatory Purgatory”)

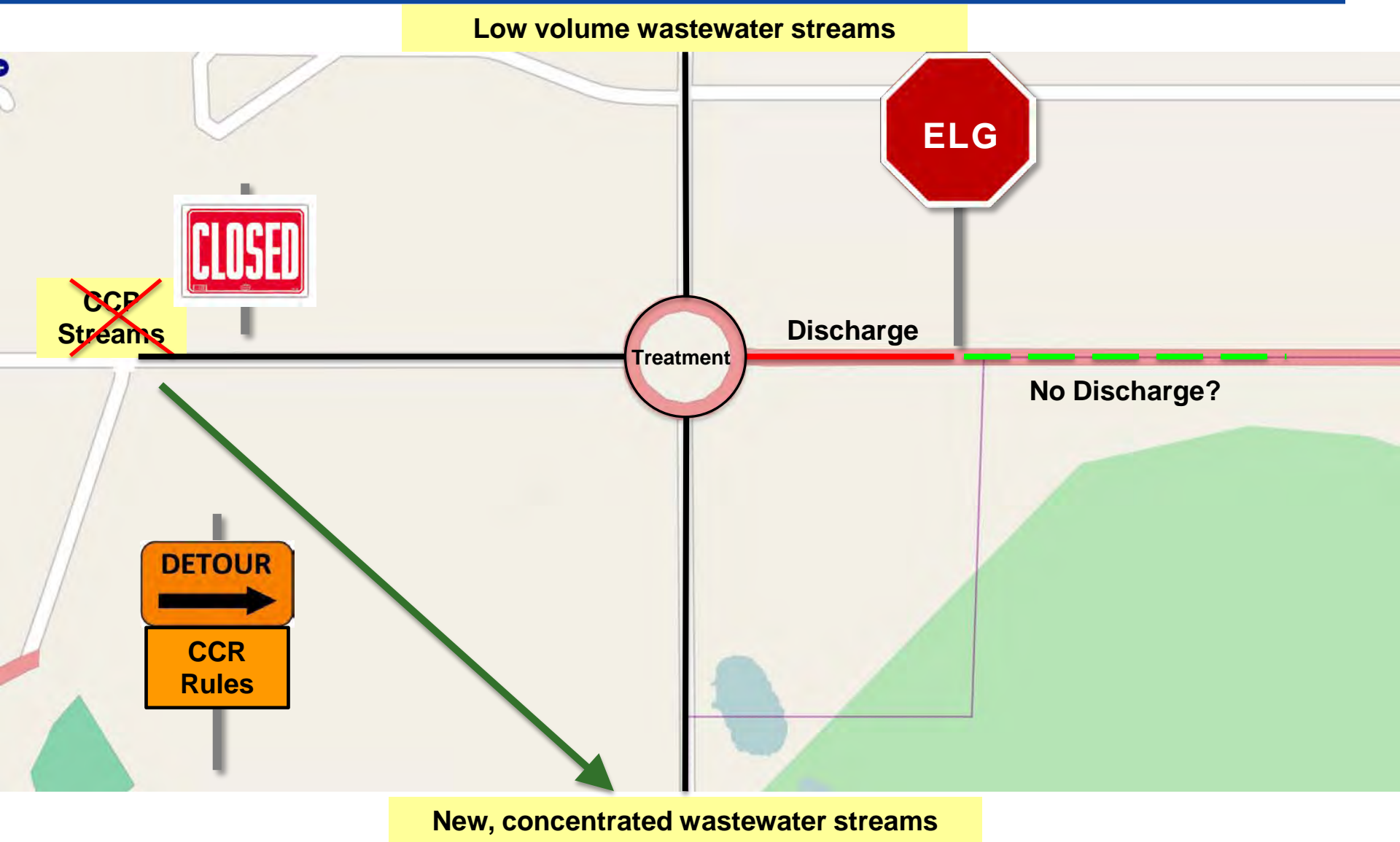
Solution

- **Understand and Evaluate the Risk (develop a regulatory approach)**
 - Develop conceptual plans (identify differences between state and proposed federal regulatory requirements; compare with industry standards)
 - Determine the impact to the project
 - Develop an approach to discuss with the regulatory agencies (based on prioritization)
- **Communicate (negotiate) with Regulating Agencies**
 - Understand key triggers
 - Understand schedule constraints
 - Understand the regulatory framework that the action will be carried out through (e.g., NPDES)

Wastewater Management and Treatment



Wastewater Management and Treatment



Consider all the Options (Existing)

Table Legend:
EPA “preferred” options noted in red.
T = Treatment Technology and L = Limits




Increasing Pollutant Reduction 

	Option 1	Option 3a	Option 2	Option 3b	Option 3	Option 4a	Option 4	Option 5
FGD Wastewater	Chemical precipitation (CP) ^a	Best Professional Judgment (BPJ) determination	CP ^a and biological treatment (BT)	T: CP ^a and BT for facilities ≥ 2000 MW scrubbed capacity; BPJ determination <2000 MW L: Hg, As, Se and nitrate-nitrite ≥ 2000 MW scrubbed capacity; BPJ determination <2000 MW	T: CP ^a and BT L: Hg, As, Se and nitrate-nitrite	T: CP ^a and BT L: Hg, As, Se and nitrate-nitrite	CP ^a and BT	CP and vapor compression evaporation (VCE)
Fly Ash Transport Water	Impoundment (equal to BPT)	T: Dry handling L: Zero discharge	Impoundment (equal to BPT)	T: Dry handling ^b L: Zero discharge	T: Dry handling ^b L: Zero discharge	T: Dry handling ^b L: Zero discharge	T: Dry handling L: Zero discharge	T: Dry handling L: Zero discharge
Bottom Ash Transport Water	Impoundment (equal to BPT)	T: Impoundment L: Equal to BPT	Impoundment (equal to BPT)	T: Impoundment L: Equal to BPT	T: Impoundment L: Equal to BPT	T: Dry handling/ closed loop ^c for units >400 MW; Impoundment ≤	Dry handling/ closed loop ^c	Dry handling/ closed loop ^c
Combustion Residual Leachate	Impoundment (equal to BPT)	T: Impoundment L: Equal to BPT					CP ^a	CP ^a
FGMC Wastewater	Impoundment (equal to BPT)	T: Dry handling L: Zero discharge					T: Dry handling L: Zero discharge	T: Dry handling L: Zero discharge
Gasification Wastewater	VCE	T: VCE L: Hg, As, Se, TDS	VCE	T: VCE L: Hg, As, Se, TDS	T: VCE L: Hg, As, Se, TDS	T: VCE L: Hg, As, Se, TDS	VCE	VCE
Nonchemical Metal Cleaning Wastes	CP	T: CP L: Cu, Fe	CP	T: CP L: Cu, Fe	T: CP L: Cu, Fe	T: CP L: Cu, Fe	CP	CP

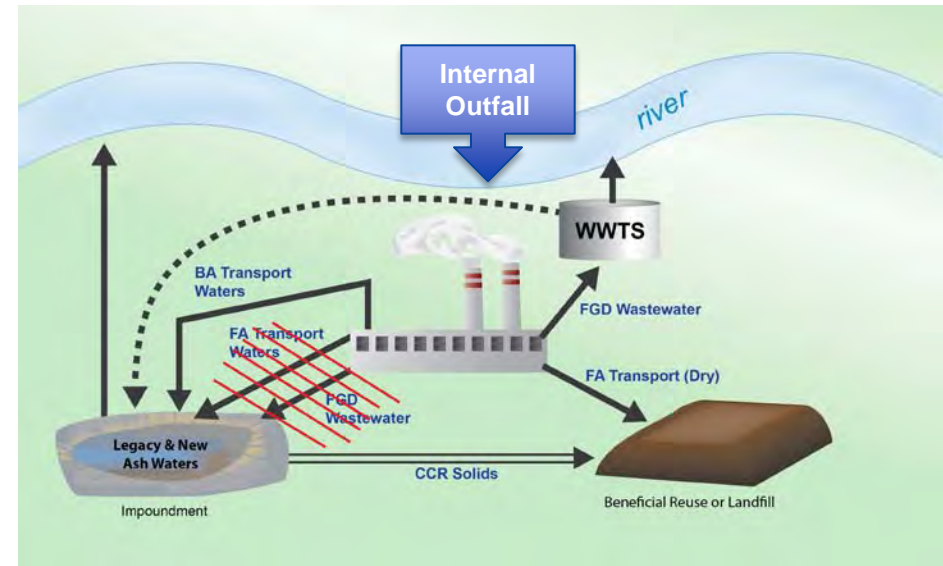
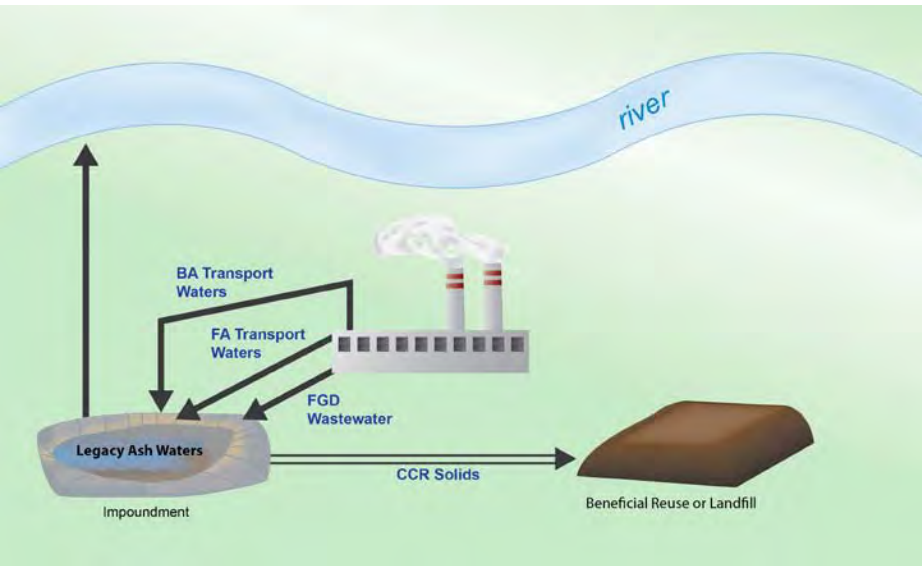
- Draft rule is released June 2013
 - Complex matrix of options
 - Comment format
- Unclear of the final approach
- Final rule released May 2014 (?)

Consider all the Options (Existing) – EPA Preferred

Increasing Pollutant Reduction 

	Current Conditions	Option 3a	Option 3b	Option 3	Option 4a
FGD Wastewater (including gypsum wash water)	Included as Low Volume Wastes T = Impoundment L: TSS & Oil and Grease	BPJ determination (technology and limits)	T: Chemical Precipitation(CP) ^a and Biological Treatment (BT) for facilities ≥ 2000 MW scrubbed capacity; BPJ determination <2000 MW L: Hg, As, Se and nitrate-nitrite ≥ 2000 MW scrubbed capacity; BPJ determination <2000 MW	T: CP ^a and BT L: Hg, As, Se and nitrate-nitrite	 Treatment
Fly Ash Transport Water	T: Impoundment L: TSS & Oil and Grease	T: Dry handling ^b L: Zero discharge	 No Discharge		
Bottom Ash Transport Water	T: Impoundment L: TSS & Oil and Grease	T: Impoundment L: Equal to BPT (no change from current rule)	 No Change!		T: Dry handling/ closed loop ^c for units >400 MW; Impoundment ≤ 400 MW L: Zero discharge for units >400 MW; Equal to BPT ≤ 400 MW
Coal Combustion Residual Leachate	Included as Low Volume Wastes T = Impoundment L: TSS & Oil and Grease	T: Impoundment L: Equal to BPT (no change from current rule)			} <i>No longer regulated as low volume wastes</i>

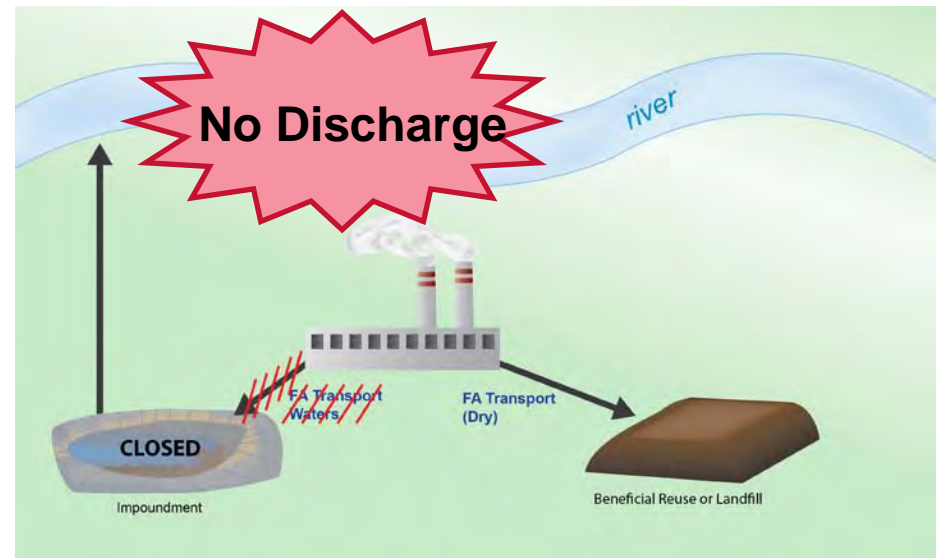
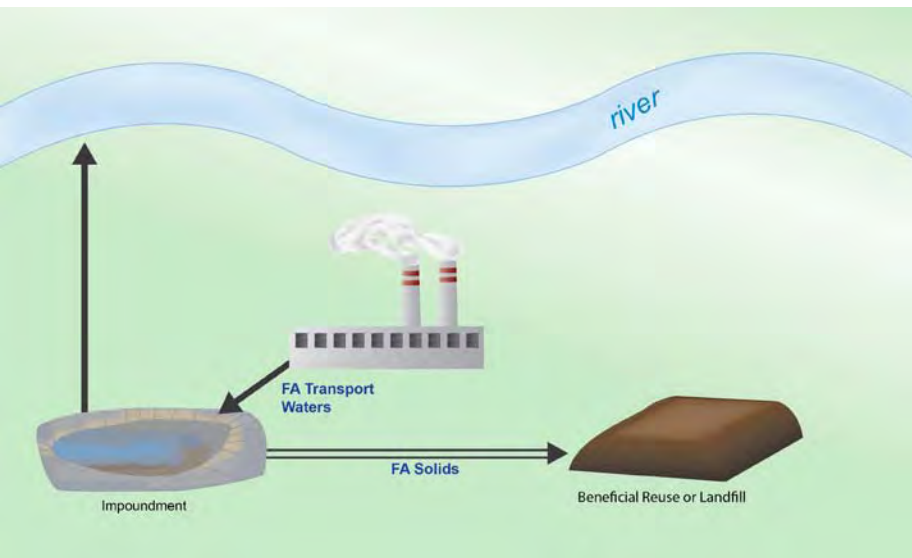
Existing Pond Continues to Operate



Existing Pond: Continue to receive new CCR Leachate or BA transport waters (and legacy ash)

- **ELG Rule:** Legacy ash subject to BPT (TSS and Oil & Grease); New CCR Leachate or BA transport waters acceptable
- **CCR Rule:** As proposed in 2010:
 - Subtitle C: Pond to close in 5 years +/-
 - Subtitle D: Pond to close in 5 years +/- OR line the pond and continue to operate

Existing Pond Ceases to Operate



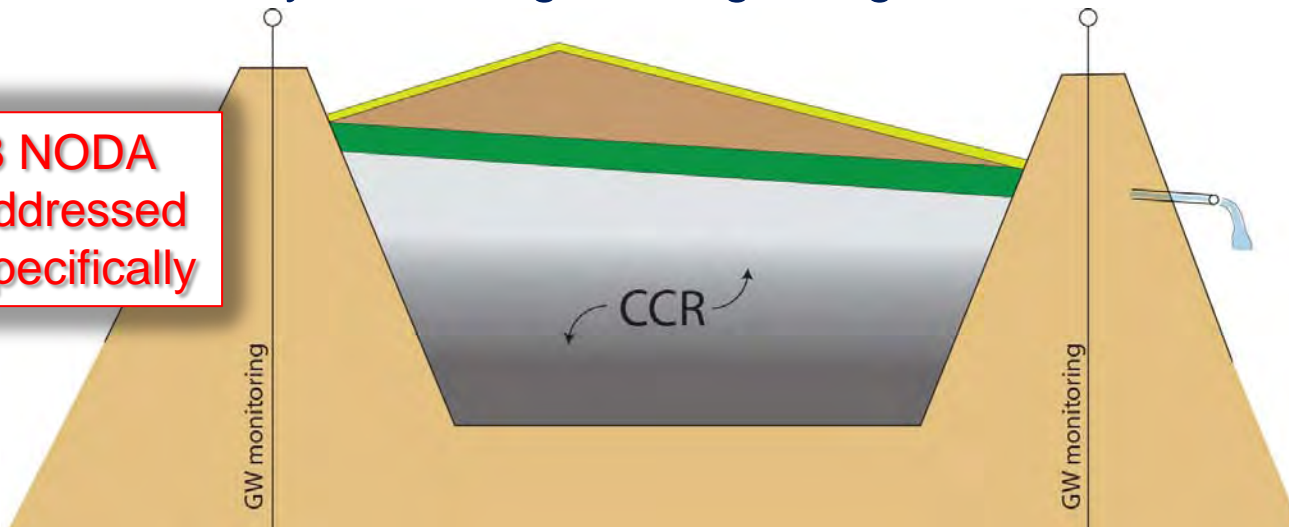
Existing Pond: No new CCR streams introduced to pond (due to new ELG rules)

- **ELG Rule:** Legacy ash subject to BPT (TSS and Oil & Grease) and can continue to discharge
- **CCR Rule:** As proposed in 2010:
 - Subtitle C or D: Pond to close in 5 years +/-; however, since no new CCR streams added, the pond ceases operation...
 - Therefore, ponds to begin closure 30 days after ceasing the receipt of CCRs and complete closure within 180 days.

Impact of the CCR Rules – Focus on Pond Closures

- According to the draft CCR Regulations, ponds to begin closure 30 days after ceasing the receipt of CCRs and complete closure within 180 days.
 - “The owner or operator of the...surface impoundment must begin closure activities no later than 30 days after the date on which the CCR landfill or surface impoundment receives the known final receipt of CCR”
 - “The owner or operator of the CCR...surface impoundment must complete closure activities in accordance with the closure plan within 180 days following the beginning of closure...”

The 2013 NODA Request addressed this topic specifically



Impact of the ELG Rules for CCR Facilities:

- BMPs under consideration are similar to the structural integrity inspection and corrective active requirements proposed in the CCR rule, but do not include closure requirements proposed in the CCR rule.
- BMPs for CCR Surface Impoundments requirements are twofold:

Part 1: Inspections

- Period ic inspections
- Record keeping on site
- Take action for potentially hazardous conditions

Part 2: Integrity - Establish BMPs for coal slurry impoundments, regulated by MSHA.

- Submit to EPA or the authorized state plans for the design, construction, and maintenance of existing impoundments and closure,
- Inspections by trained personnel who are knowledgeable in impoundment design and safety, and
- Provide an annual certification of compliance with plans

- These BMPs would apply to all CCR impoundments regardless of activity level, height, and storage.
- EPA is considering possible variations to the above.
- Revised Risk Assessment: Subtitle D may be adequate for CCRs

Wastewater management and treatment

Solution

- **Include wastewater treatment approach in overall CCP program**
 - An initial assessment of all (existing and new) wastewater streams
 - Develop evaluation of treatment alternatives and select
 - Include these results into overall plant project schedules

- **Regulatory drivers (ELG) may impact overall approach**
 - Result in pond closure(s) and/or revisions to CCP Management practices



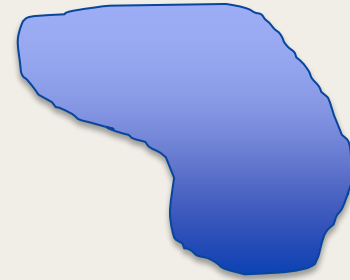
Adherence to schedules (project, permitting, construction, etc.)

START
Beginning CCP
Management
Condition

**Project 1
Complete**

**Project 2
Complete**

END
Final CCP
Management
Condition



Adherence to schedules (project, permitting, construction, etc.)

START
Beginning CCP
Management
Condition

**Project 1
Complete**

**Project 2
Complete**

END
Final CCP
Management
Condition



End of
wet disposal

1 to 2 years

Design of Final Closure



2 ½ to 3 years

Dry CCR Handling Infrastructure



3 to 4 years

Non-CCR Wastewater Treatment

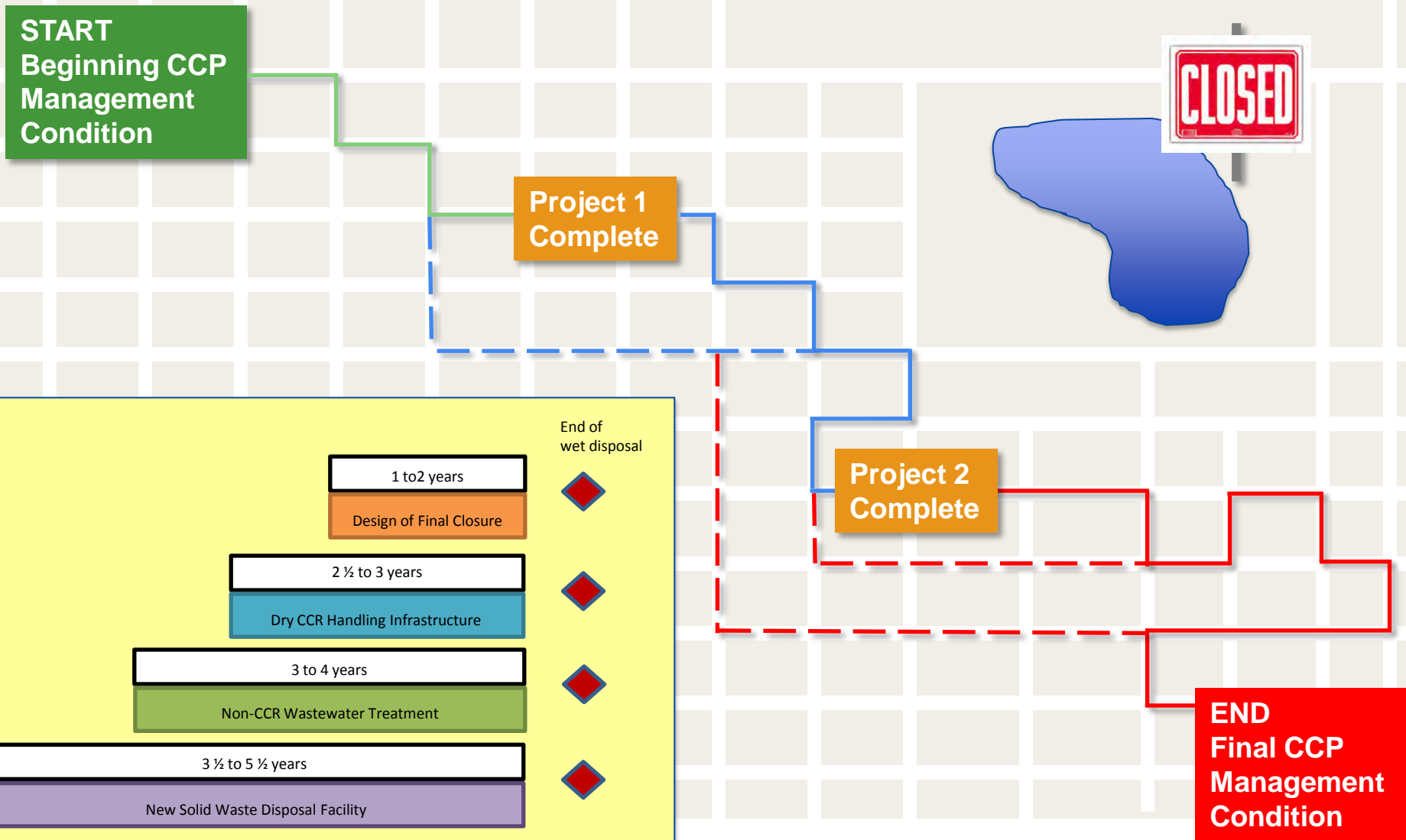


3 ½ to 5 ½ years

New Solid Waste Disposal Facility

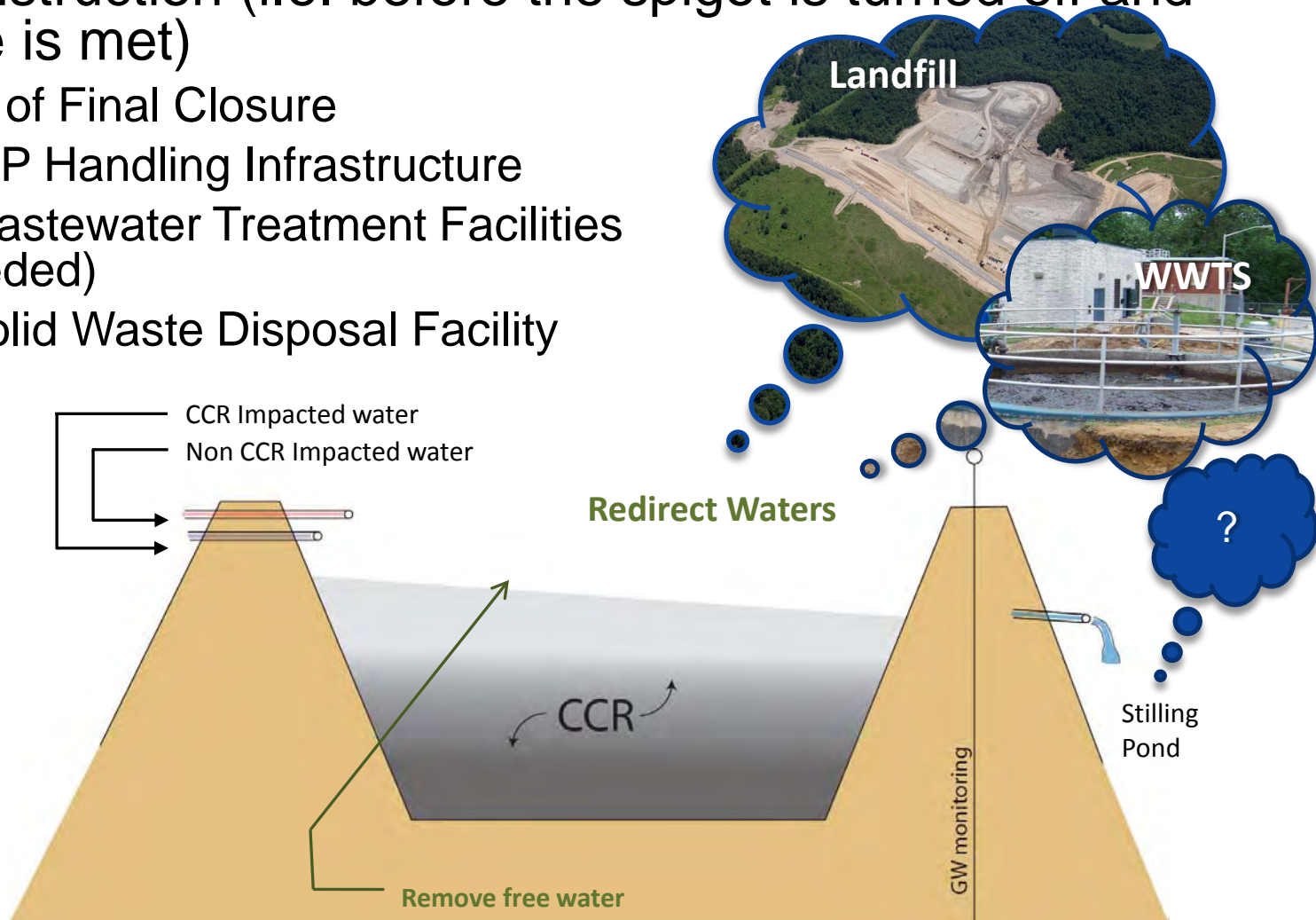


Adherence to schedules (project, permitting, construction, etc.)



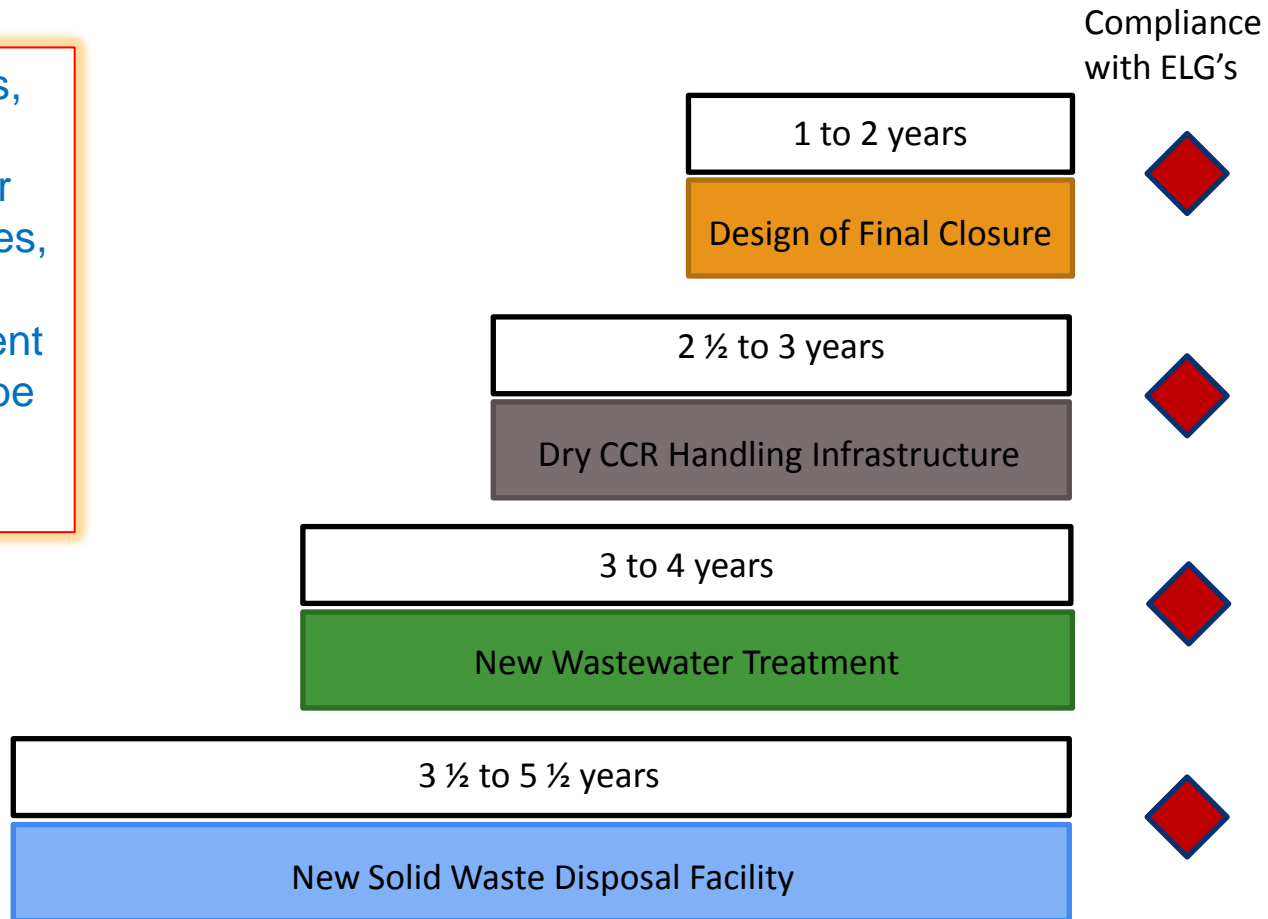
Understanding Schedule Constraints

- The following may be needed prior to the start of final closure construction (i.e. before the spigot is turned off and compliance is met)
 - Design of Final Closure
 - Dry CCP Handling Infrastructure
 - New Wastewater Treatment Facilities (as needed)
 - New Solid Waste Disposal Facility



Overall Dry CCR Conversion/Pond Closure Process

These tasks, while each having their own schedules, are VERY interdependent and should be executed together.



*The time to begin is...**NOW!!!***

Adherence to schedules (project, permitting, construction, etc.)

Solution

- **Early development of project schedules that include key elements of adjacent projects (create a master/program schedule)**
- **Involvement of regulatory authorities to identify “hard spots” and possible rule exemption requests**
- **Regular schedule meetings to check progress and enforce milestones**
- **Early start on projects...DON'T WAIT TILL THE LAST MINUTE**



Experienced Team Members (engineering, consultant, construction, contractors, etc.)

Start

- Experienced Teams
- Sophisticated Understanding

On the job training

End

- Effective and Efficient Designs (construction and operation)

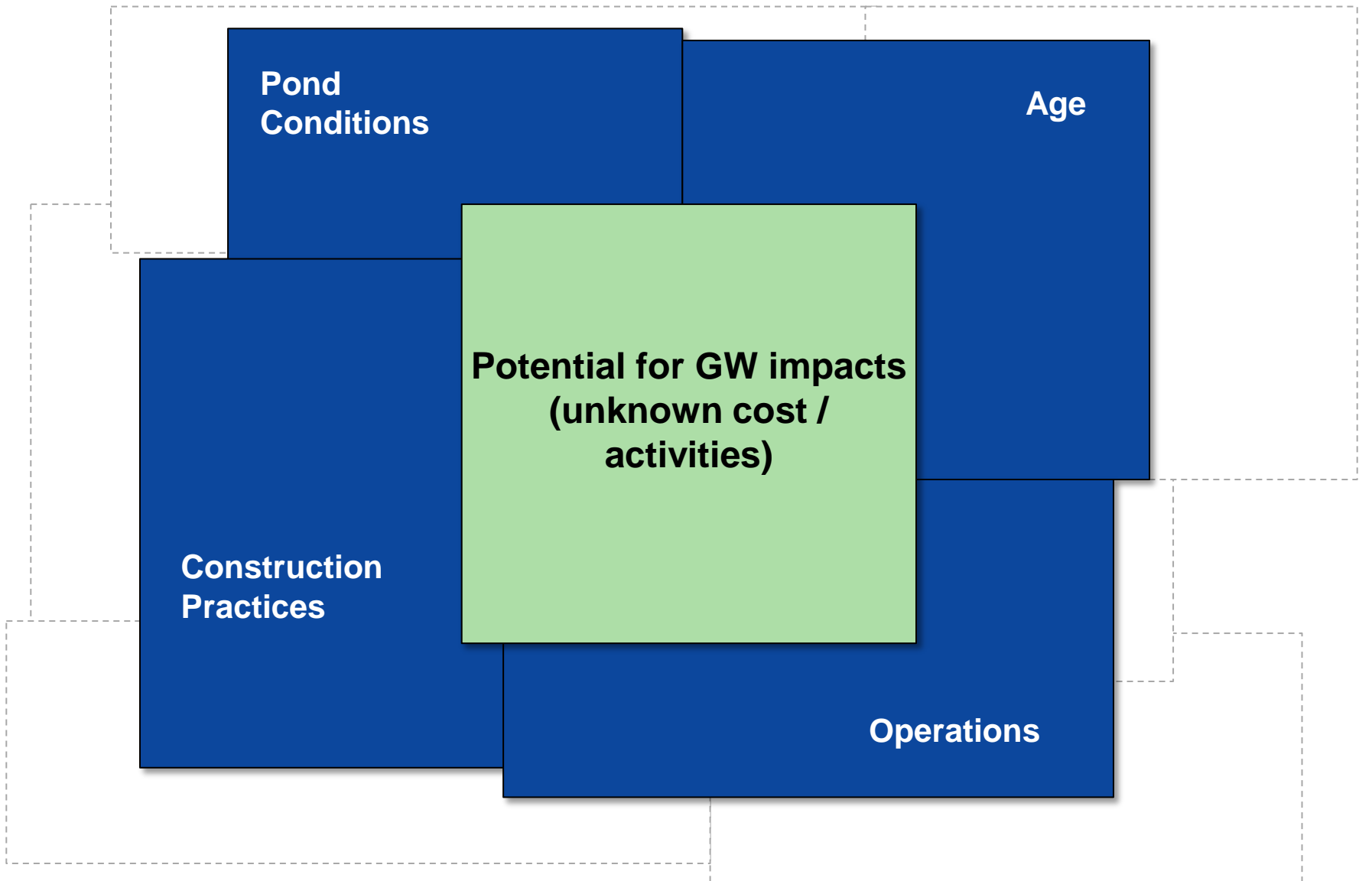
Experienced Team Members (engineering, consultant, construction, contractors, etc.)

Solution

- **Select team members with demonstrated experience and expertise to avoid issues**
- **Consider combining related projects and have one team**
- **Consider selecting a smaller number of qualified consultants to manage a collection of like projects (identify a lead consultant)**
- **Consider teams with strong relationships with regulatory agencies**



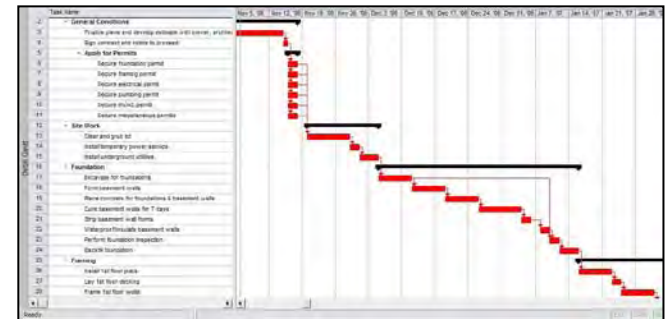
Potential Site Impacts (to Groundwater)



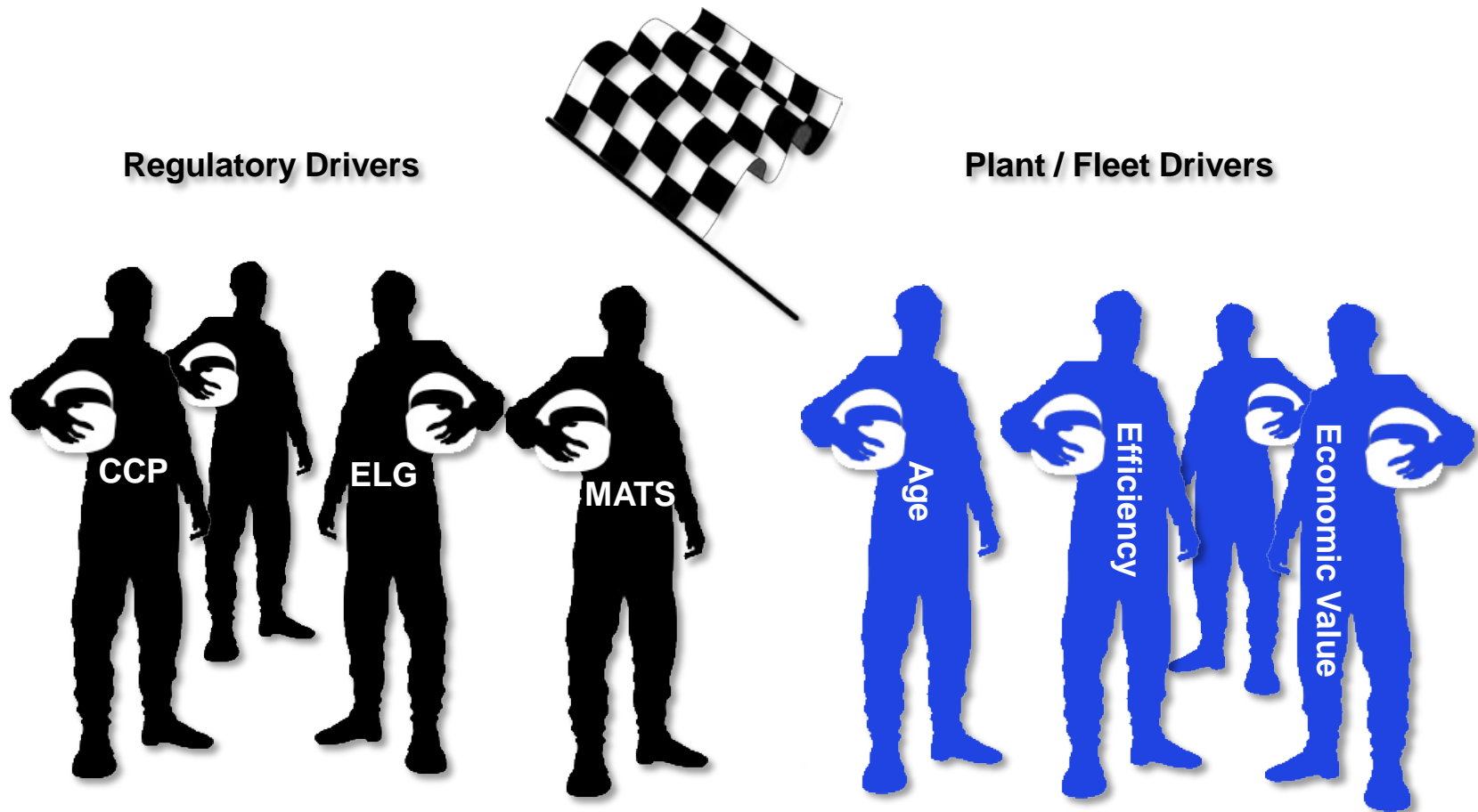
Potential Site Impacts (to Groundwater)

Solution

- **Understand potential impacts to better prepare & manage**
 - Project budgets
 - Project schedules
 - Regulatory involvement/acceptance
- **Execute a strategic planning approach**
 - Multi-phased approaches that anticipates possible outcomes
 - Implement evaluation phase prior to investigations
- **Seek a balance between risk management and project development**



Inclusion of a Strategic Planning Process



Complex Planning Process - - > Make informed decisions

Inclusion of a Strategic Planning Process

Solution

- **Conduct Strategic Planning**
- **Develop an understanding of all project milestones and intersection points**
 - Define the project scope and approach
 - Establish schedule milestones (including permitting) and predecessor activities
 - Estimate costs/cash flows
- **Regularly discuss project status, changes, etc. (impact of related drivers)**
- **Involve regulatory authorities in strategic decisions**



Changes to CCP...



...and Management



Changes to CCP...and Management

Solution

- **Identify possible changes and explore outcomes**
 - Impacts to the CCP streams characteristics
 - Evaluate management practices and the impact of changes
 - Beneficial reuse
 - Disposal source elimination
- **Execute bench scale and field scale testing**
- **Explore all options**

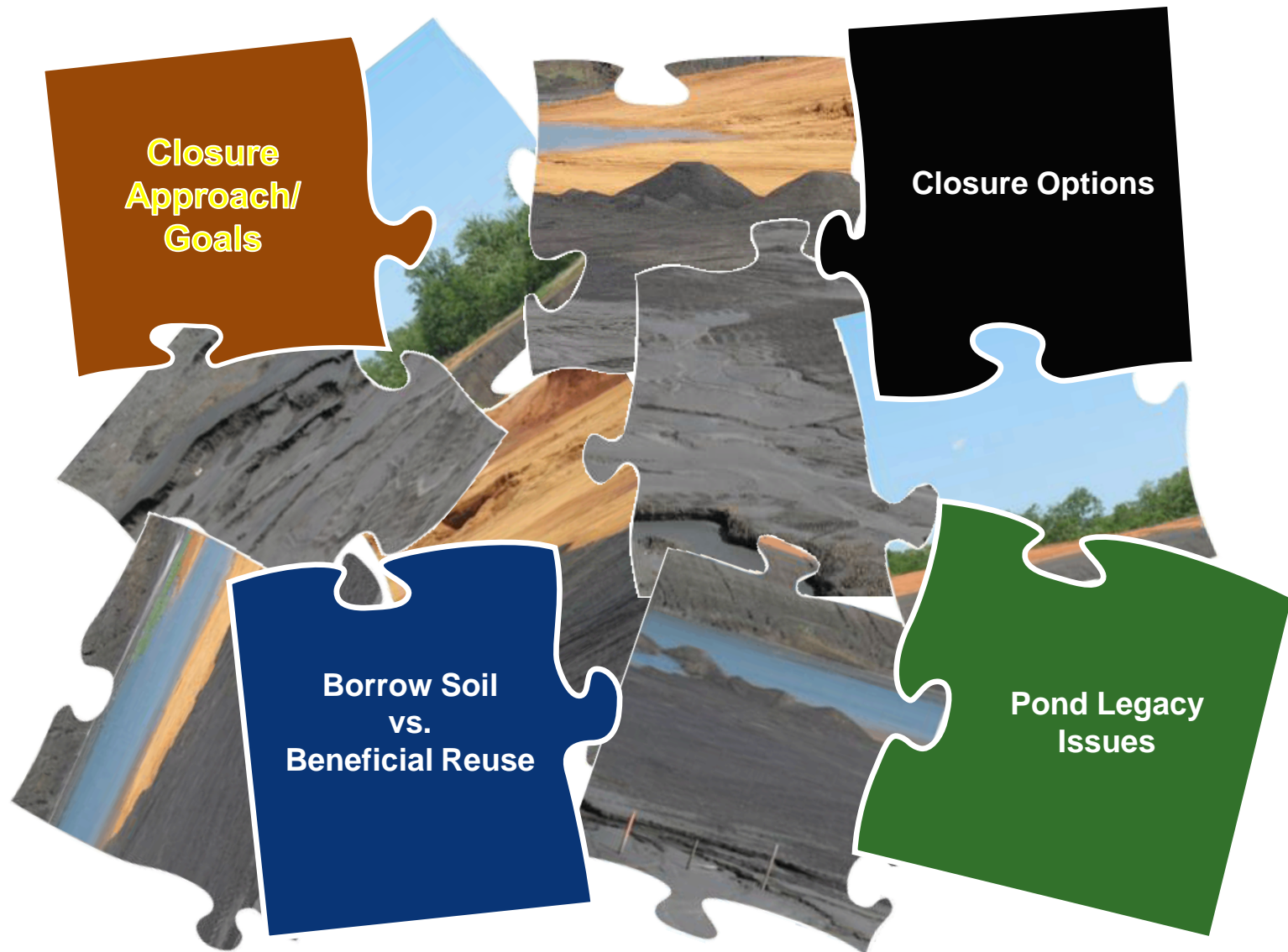




Pond Closure Options and Hurdles



Pond Closure Overview



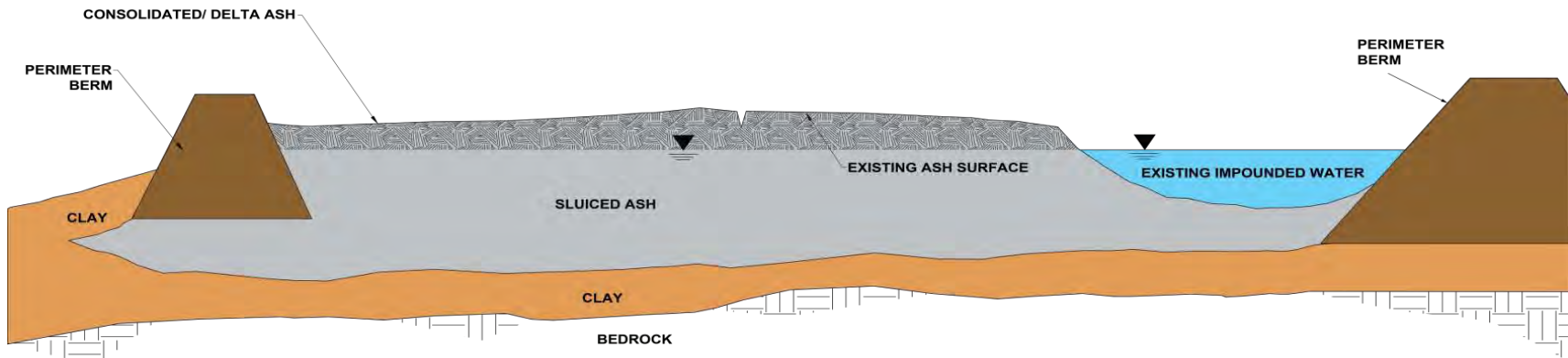
Typical Ash Pond Conditions



- **Large Area (Hundreds of Acres)**
- **Perimeter Containment Berms**
- **Open Pool Areas**
- **Delta Ash (flat/uneven grades)**
- **Special Considerations (karst, seismic, etc.)**



Typical Ash Pond Conditions



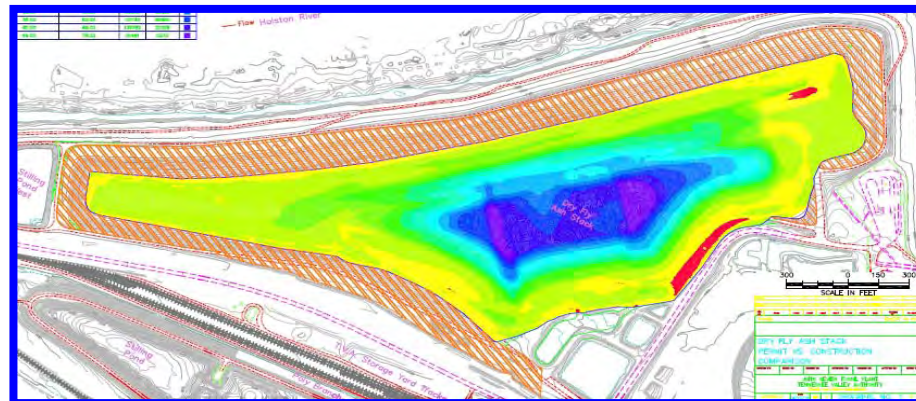
- Sluiced ash
- Impounded water
- High water content and low shear strength
- Unstable surface for personnel or equipment access
- Significant construction and operation challenges



Pond Closure Approach/Goals

Closure of ash ponds is designed to meet the following goals:

- Provide long-term function with a minimum of maintenance
- Effectively manage surface water
- Provide an effective barrier against infiltration
- Reduce current/future environmental impacts
- Meet regulatory requirements
- Meet specified closure timeline



Pond Closure Options



Pond Closure Options

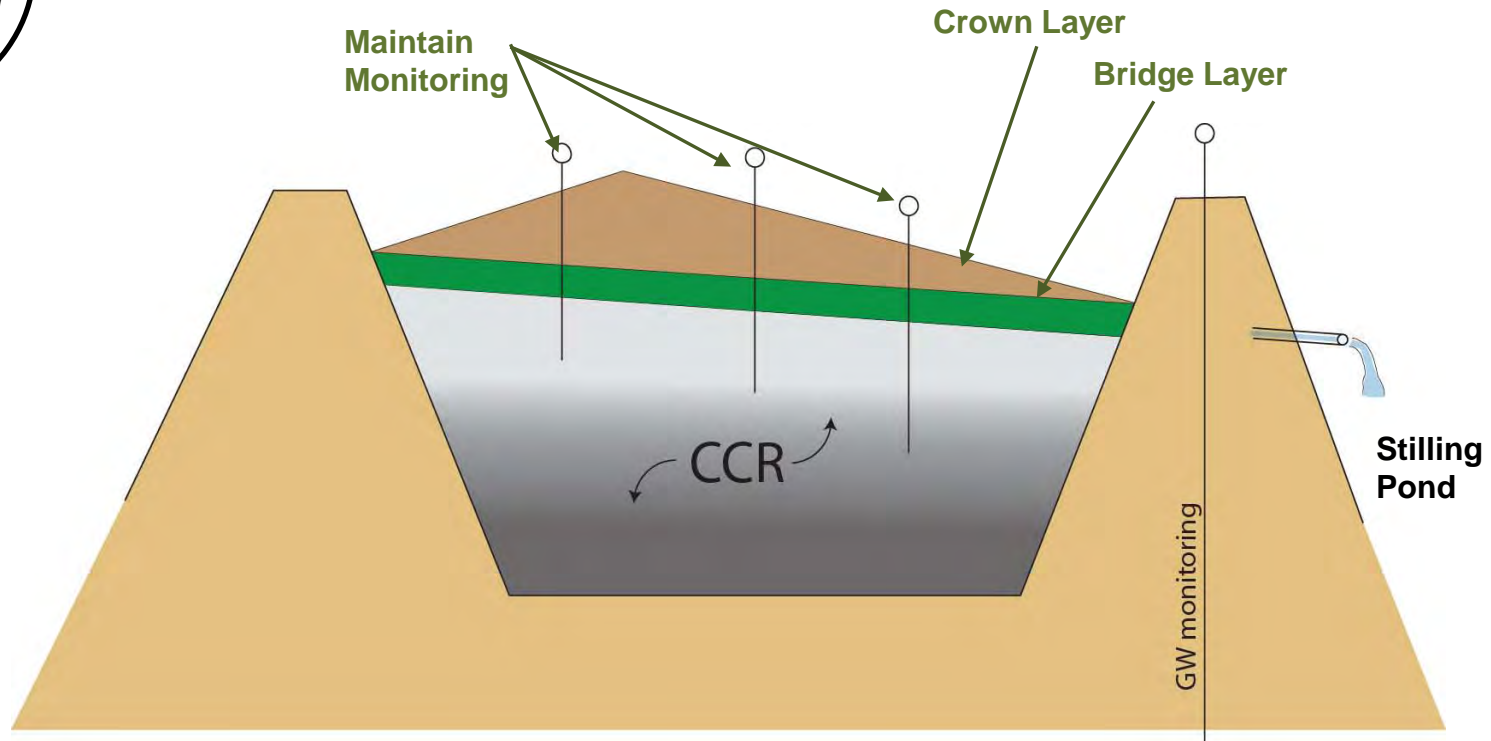
Challenges:

- Flat, uneven surface
- Soft, wet surface
- Dikes hold rain water

Considerations:

- Phased closure
- Soil material needs / constructability
- Regulatory requirements
- Be innovative...cost effective

Unlike other solid waste facilities, generally ponds were not designed and permitted for closure.



Pond Closure Options

Clean Closure

**Phased
Closure**

**Footprint
Reduction**

Repurposing

Soil Capping

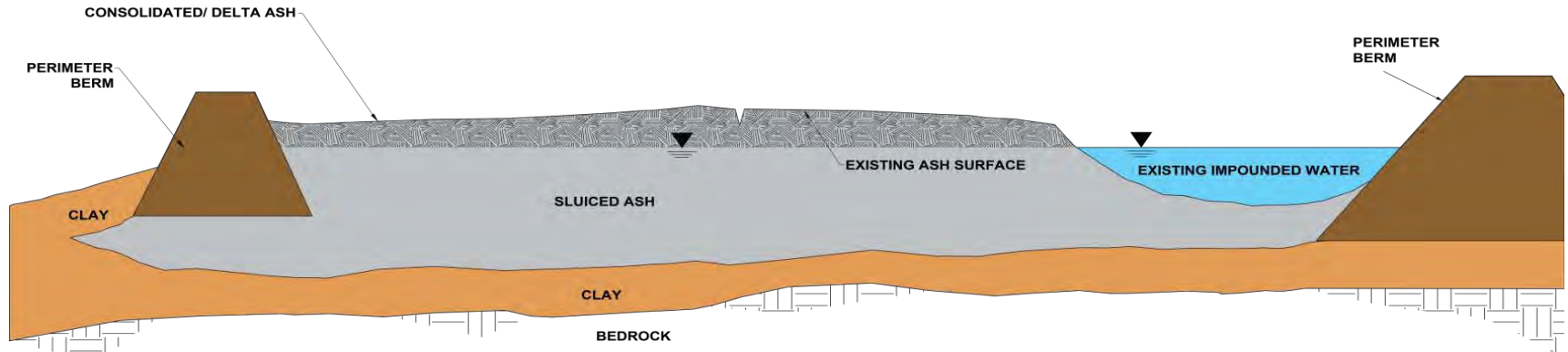
**Leachate
Collection**

**Beneficial
Reuse**

Subtitle D Cap



Clean Closure

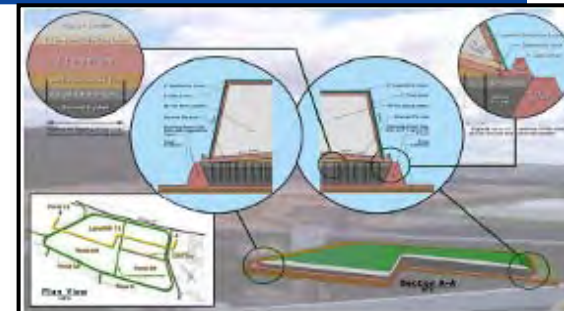
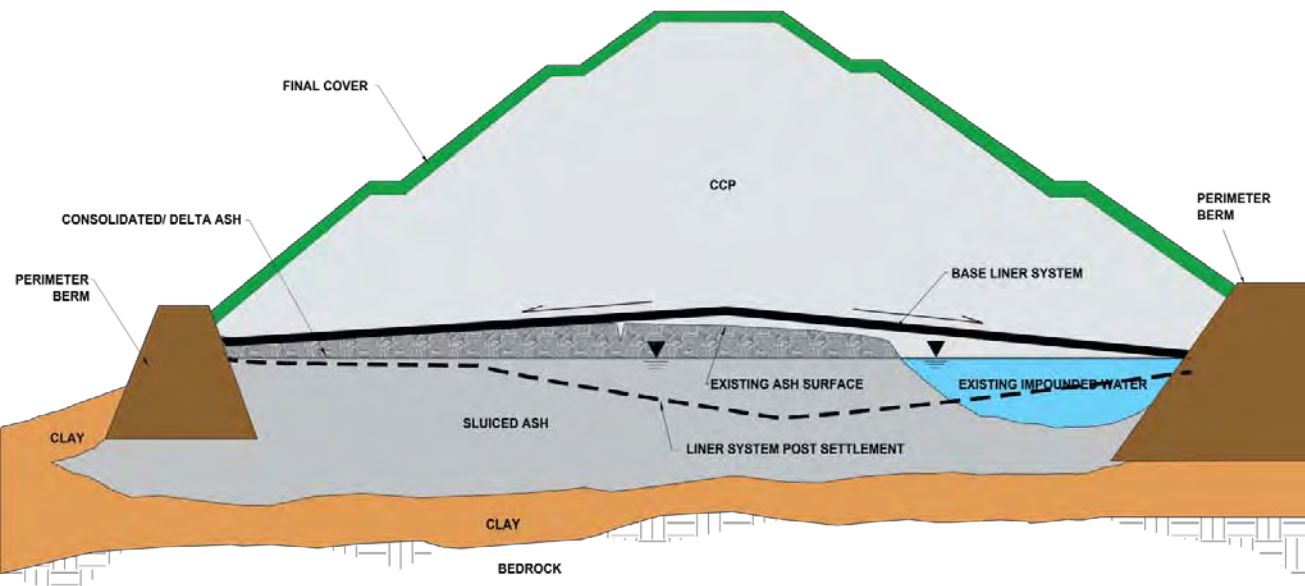


Removal of ash from ponds:

- Applicable to small ponds
- On-site storage or beneficial use available for excavated ash
- Ash dewatered prior to hauling and landfilling
- Evaluate potential subsurface impacts
- Solid waste permit not needed



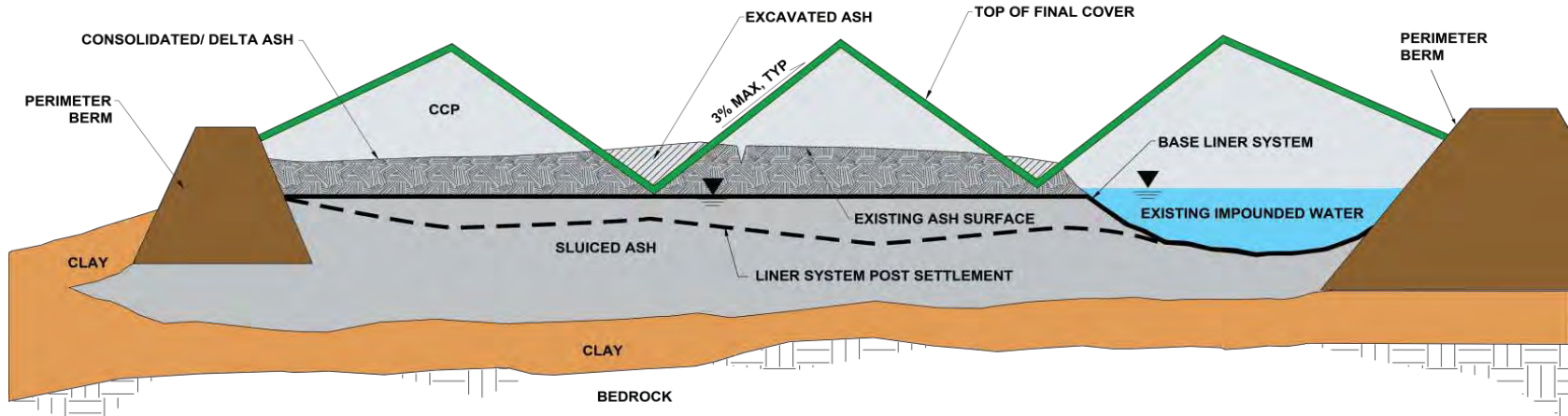
Repurposing



Landfill construction and/or alternate use:

- Can meet subtitle D requirements
- Potential for solid waste permitting
- Can meet multiple site objectives
- Potential foundation/berm stability issues
- Longer development time for closure

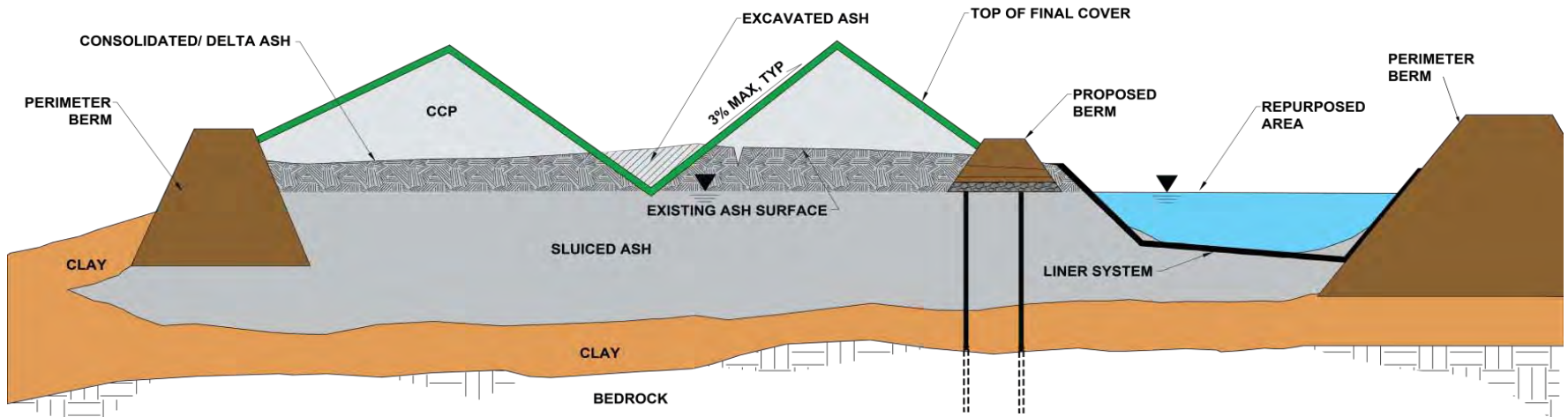
Subtitle D Closure



Achieving closure grades following liner construction:

- Meets subtitle D requirements
- Solid waste permitting
- Leachate collection
- Long development time for closure
- Potential settlement and foundation stability issues

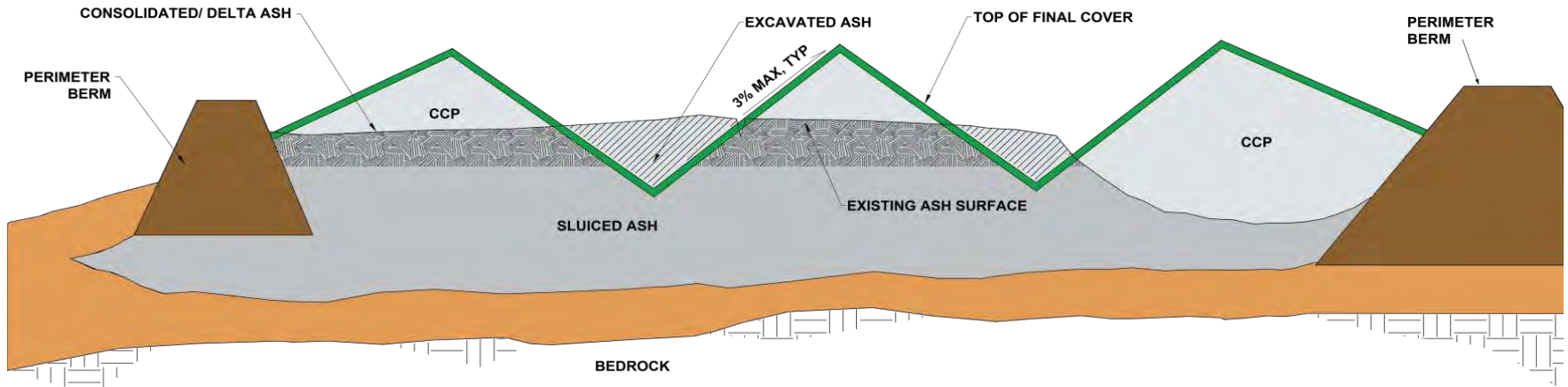
Footprint Reduction



Constructing berm interior to pond system to reduce footprint:

- Reduces footprint of closure area
- Clean closure outside of footprint
- Requires berm stabilization
- Reduces closure duration
- Allows for repurposing of “cleaned” footprint area

Capping Techniques

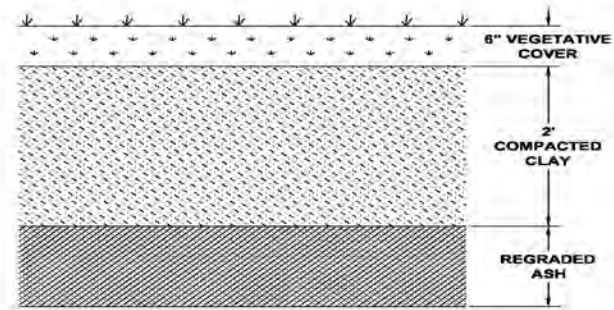


Constructing geosynthetic or soil cap on fill

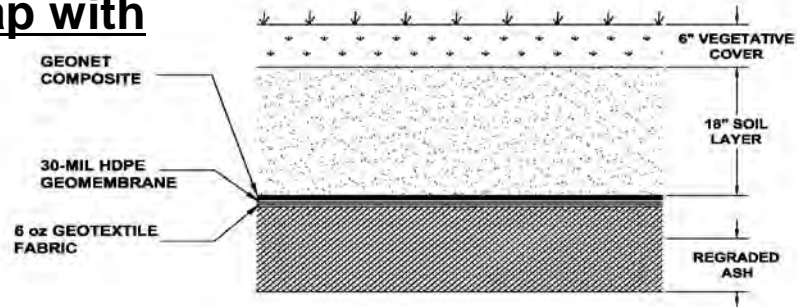
- Requires regrading and importing of fill to achieve closure grades
- Can avoid berm construction challenges
- Reduces potential risks for instability by filling in open areas
- Regulatory approval dependent upon cap system and fill source
- Can be phased to optimize capital investment and meet regulatory requirements

Capping Techniques

Soil Cap:



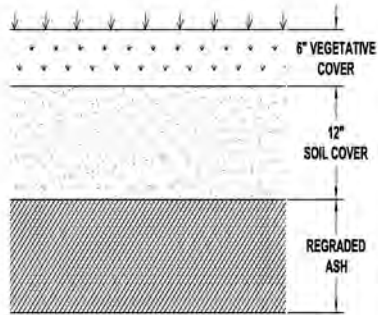
Geomembrane Cap with Soil Cover



Complete Geomembrane Cap



In-Place Closure:



Closure Phasing

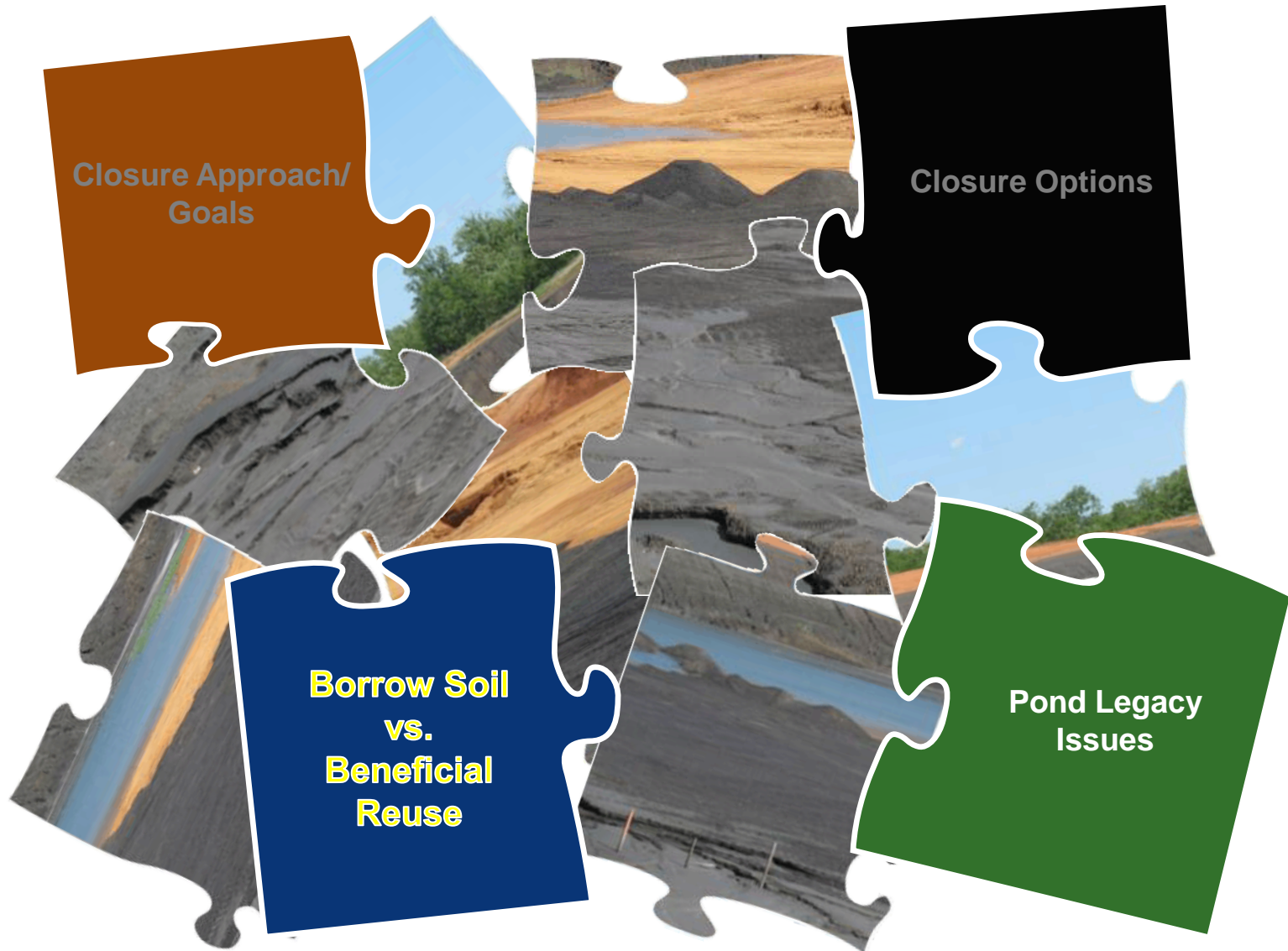
Phase closure/capping:

- Applicable to all closure options
- Allows capital to be expended over longer duration
- Reduces annual fill material needs
- Gradual operation transition
- Construction can be sequenced outside of winter months
- Can be focused in areas needing stability/seepage improvements



TASK	2015	2016	2017	2018	2019	2020	2021	2022	2023
CCP PLACEMENT	█	█			█				
PHASE 1 FINAL COVER			█						
PHASE 2 FINAL COVER				█					
PHASE 3 FINAL COVER					█				
PHASE 4 FINAL COVER						█			
PHASE 5 FINAL COVER							█		
PHASE 6 FINAL COVER								█	
PHASE 7 FINAL COVER									█

Borrow Soil vs. Beneficial Reuse



Borrow Soil vs. Beneficial Reuse

Closure/capping of ponds can require significant fill materials:

- **Fills can be obtained from borrow areas or CCP's**
 - **Assess CCP generation and properties**
 - **Review potential on-site and off-site borrow areas**
- **Regulatory drivers**
 - **Are CCP's consistent with pond constituents**
 - **Can beneficial use be approved under NPDES**
 - **CCR regulations**



280,000 CY+
for a 2% slope

20,000 trucks



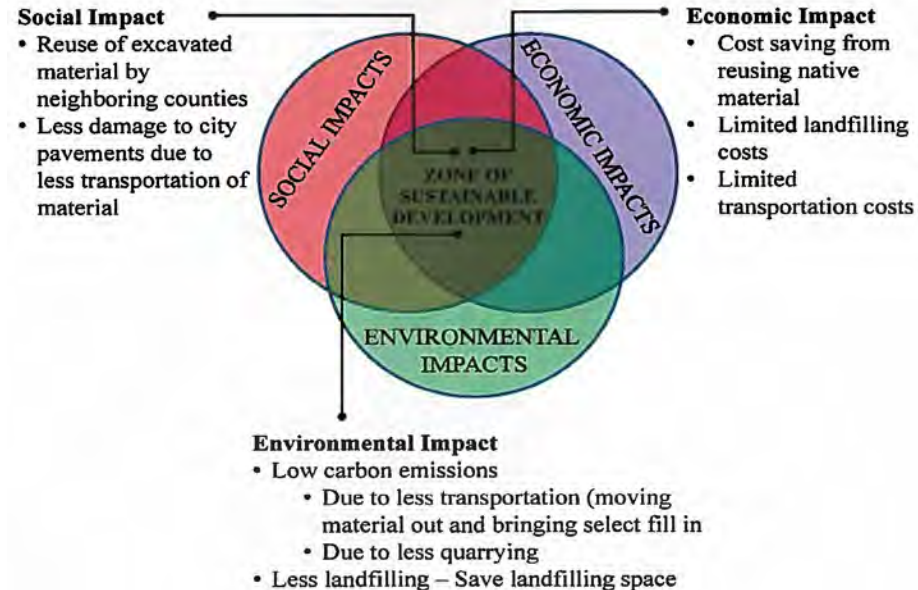
Borrow Soil vs. Beneficial Reuse

- Environmental impacts

- Purchase and acquisition of undeveloped land
- Erosion and sediment control
- Traffic and highway safety
- Road and bridge degradation
- Air emissions
- Consider future capping benefit

- Constructability/Closure Timing

- Are sufficient quantities of material available for closure timeline
- Are material properties sufficient for structural fill

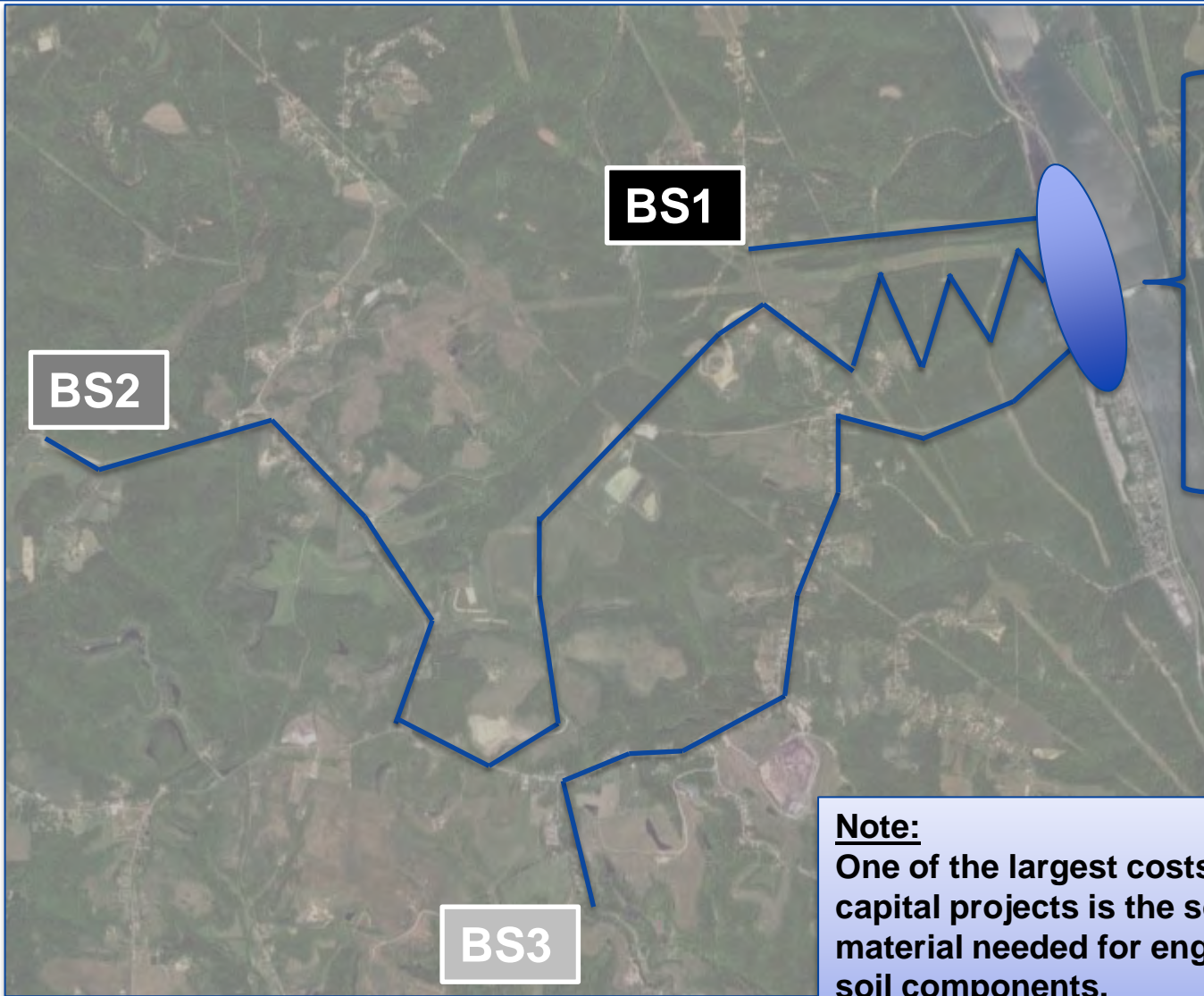


Borrow Soil vs. Beneficial Reuse

Borrow Source Factors:

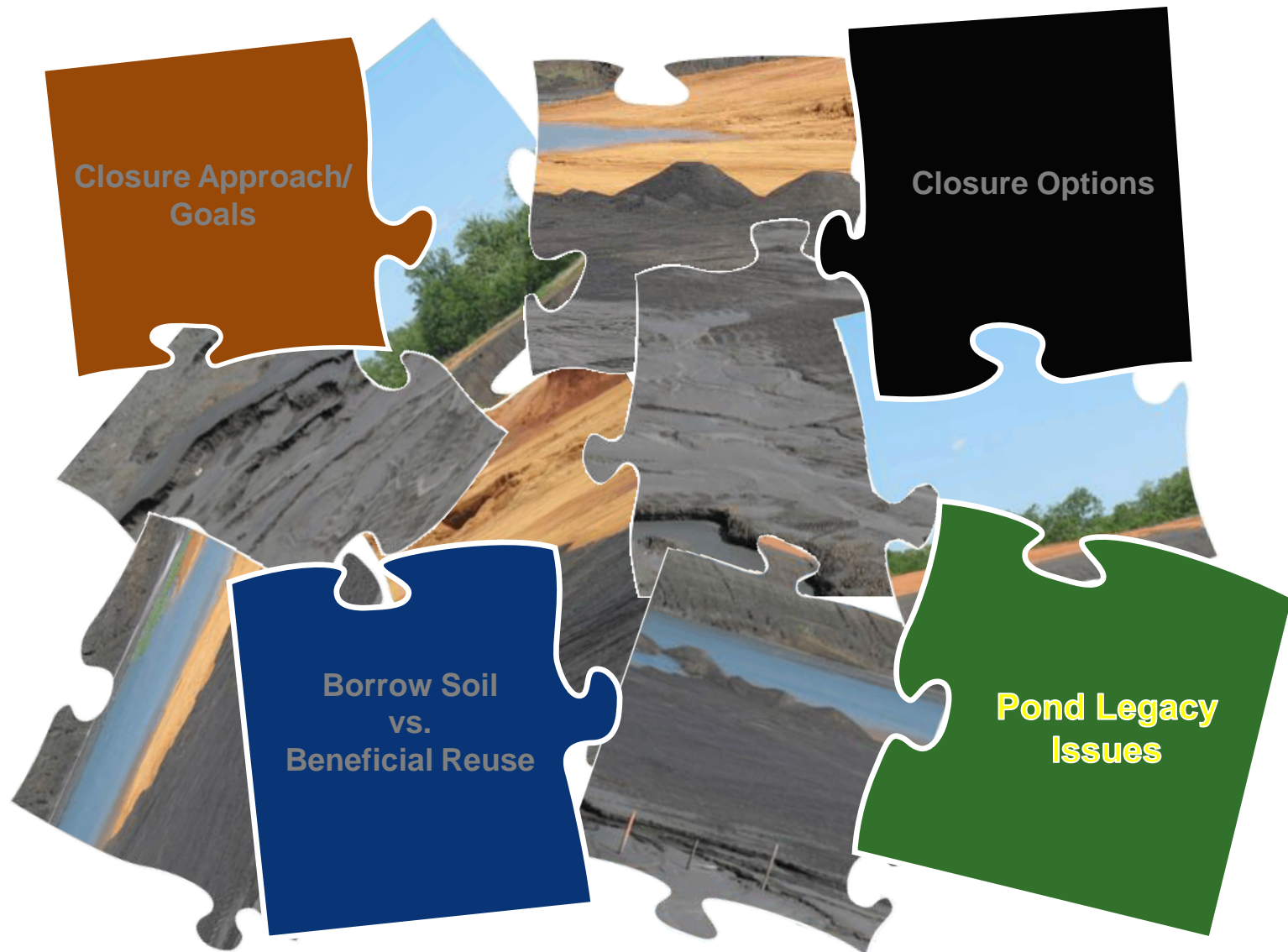


Transportation



Note:
One of the largest costs in CCP capital projects is the soil material needed for engineered soil components.

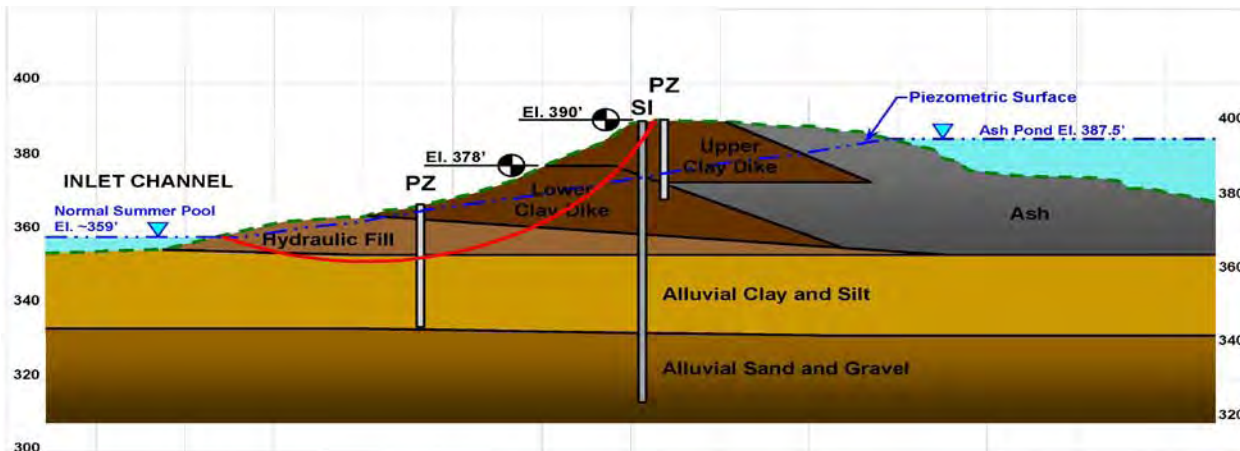
Pond Legacy Issues



Legacy Issues

Facility age and changes in design standards:

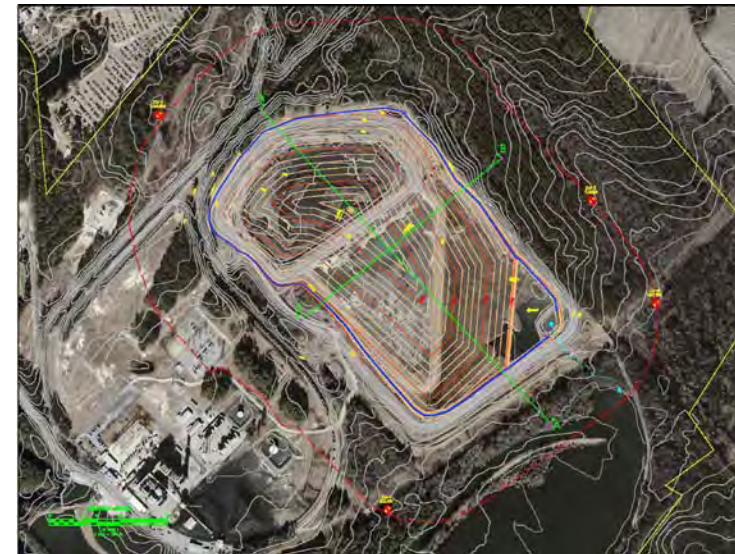
- Perimeter dikes constructed over soft subgrades reducing stability and factors of safety
- Perimeter dikes not designed to meet current seismic standards
- Seepage through existing perimeter dikes reducing stability
- Existing hydraulic conveyance inadequate for current design storm events
- Groundwater



Legacy Issues - Evaluation

Understanding the issues at hand:

- **Review of historic information**
- **Visual inspections**
- **Defining design standards and criteria**
- **Topographical and hydrographic surveys**
- **Subsurface investigations and testing**
- **Static and seismic stability analysis**
- **Seepage analysis**
- **Groundwater monitoring/modeling**
- **Hydraulic modeling for PMF analysis**



Legacy Issues - Solutions

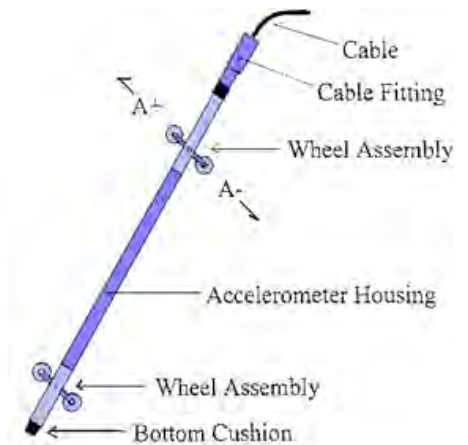
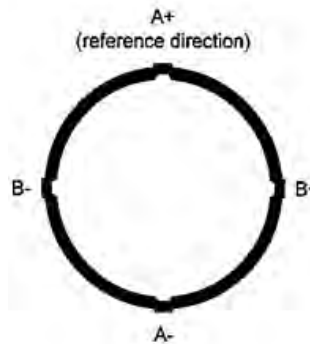
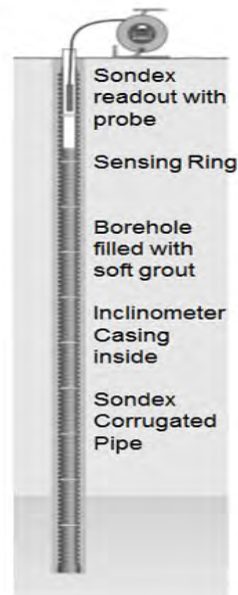
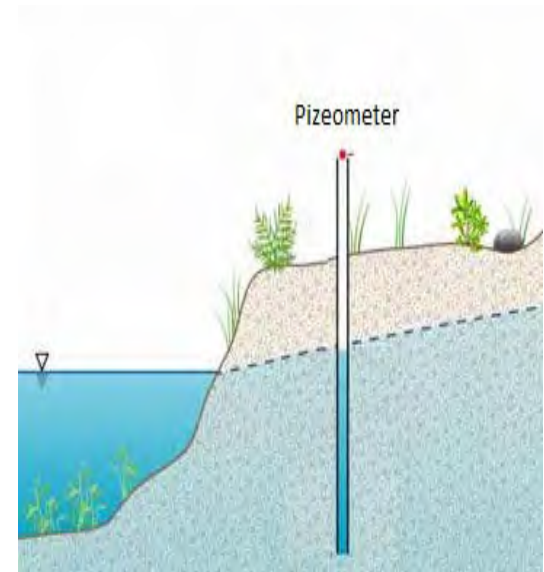
Numerous methods available :

- Operational changes
 - Pond lowering
 - Internal ditching/Piping
- Hydraulic structures
- Long-term monitoring
- Dike reconfiguring
 - Slope flattening
 - Internal slope buildup
- Buttressing
- Reverse Graded Filters
- Capping



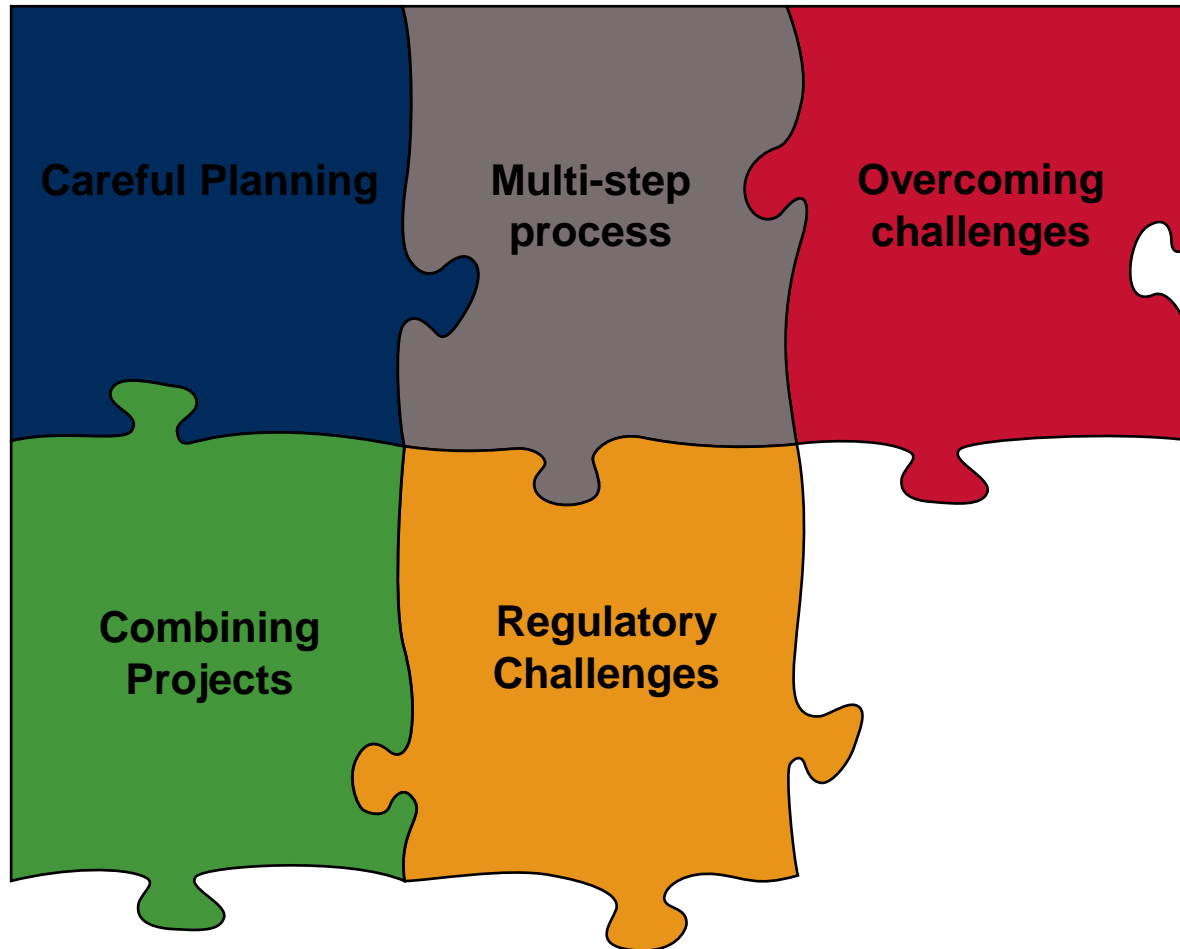
Long-Term Monitoring

- Piezometers for Groundwater and Pore Pressure
- Slope Inclinometers for lateral displacement
- Sondex Settlement – vertical deformation



Conclusions

Solving a complicated puzzle for CCR Management:



It is a lengthy process...begin now!



Greatest Challenges to Effective CCR Management



Presentation to Reinhold Conference

Presented by:

Mark Rokoff, PE

National CCP Management Practice Lead

Gabe Lang, PE

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February 10, 2014

