AGENDA FOR KINGSTON SCRUBBER WET GYPSUM STACKING DISPOSAL

Wednesday November 19, 2003, 10:30 am

10:30 - 11:30	Introduction and Overview of Project • Review of KIF Site • Review of Phase 1A Drawings • Gypsum Quantities • Objectives	Dan Smith/Larry Bowers
11:30 - 12:15	Lunch (on your own)	
12:15 - 1:00	Discussion of Design Considerations • Underdrain design considerations; • Use of gypsum as starter dike • Stack drainage	Group
1:00 – 3:00	Configurations for Stack Construction, Including Operational Considerations	Group
3:00 - 4:00	Selection of Optimal Design Configuration	Group
4:00 – 4:30	Wrap Up	Group

Thursday November 20, 2003

7:30 am	Meet at TVA (exact location to be determined) & leave for Kingston Fossil Plant
9 - 9:30 am	Assemble at Parking lot near ammonia unloading facility
9:30 - 10:30	Site visit
10:30 – 11:30	Meet at EPRI Conf Room; Review of project (assumptions) with plant representatives
11:30 – 12:15	Working Lunch
12:15 –2:30	Presentation to plant representatives of engineering recommendations for conceptual design (basis of Phase 1 costs)
2:30 – 3:00	Wrap up

Kingston Fossil Plant

Gypsum Stack Conceptual Design
Background and Objectives

Kingston Fossil Plant - Summary of Gypsum Disposal Options

	DESCRIPTION	POTENTIAL VOLUME[1] (million cy)	SITE PREP COSTS[6] (1000$)	PERMITTING ISSUES	ADVANTAGES	DISADVANTAGES
1A	New facility located in greenfield site at the peninsula area	3:1 Slope: 9.3 4:1 slope: 7.5	$9,400[2]	▪▪Karst geology not impediment to permit[4].	▪▪Adds additional disposal capacity to plant.	▪▪Unknown extent of soft soil layer may reduce stack height and volume; foundation drain beneath liner may be required.
1B	New facility located in greenfield site at the peninsula area – reduced footprint	3:1 Slope: 7.0 4:1 slope: Not computed	$7,400[2]	▪▪Karst geology not impediment to permit[4].	▪▪Adds additional disposal capacity to plant ▪▪Smaller footprint may offset disadvantages associated with underlying soft soils.	▪▪Unknown extent of soft soil layer may reduce stack height and volume; foundation drain beneath liner may be required. ▪▪Smaller footprint sacrifices about 30% volume compared with 1A.
2A	Gypsum stack segregated from ash stack; gypsum co-located with ash disposal in existing ash pond – conversion to dry ash	3:1 Slope: 12.1 4:1 slope: 9.8	$25,000[3,5]	▪▪Already has permit for ash disposal.	▪▪Site is favorable for wet stacking. ▪▪Disposal volume is greater than either Option 1A or 1B. Smaller footprint does not sacrifice significant volume compared with 1A.	▪▪Does not add disposal capacity to plant. ▪▪Additional costs required for dry stacking ash.
2B	Gypsum stack and ash stack combined; gypsum co-located with ash disposal in existing ash pond – conversion to dry ash	3:1 Slope: 18.7 4:1 slope: 15.2	$23,000[3,5]	▪▪Already has permit for ash disposal.	▪▪Offers the largest potential for disposal volume. ▪▪Site is favorable for wet stacking.	▪▪Does not add disposal capacity to plant. ▪▪Additional costs required for dry stacking ash.
3A	Gypsum stack segregated from ash stack; gypsum co-located with ash disposal in existing ash pond – continue wet ash stacking	3:1 Slope: 12.1 4:1 slope: 9.8	$25,000[3,5]	▪▪Already has permit for ash disposal.	▪▪Site is favorable for wet stacking. ▪▪Disposal volume is greater than either Option 1A or 1B.	▪▪Does not add disposal capacity to plant.
3B	Gypsum stack and ash stack combined; gypsum co-located with ash disposal in existing ash pond – continue wet ash stacking	3:1 Slope: 18.7 4:1 slope: 15.2	$23,000[3,5]	▪▪Already has permit for ash disposal.	▪▪Offers the largest potential for disposal volume. ▪▪Site is favorable for wet stacking.	▪▪Does not add disposal capacity to plant.

Footnotes:

1. Volume is measured in cubic yards. Gypsum production estimates are measured in tons. A density of 1 ton/cy (approx 75 lb/cf) is assumed for the study.
2. Costs for Options 1A and 1B do not include a foundation drain beneath the facility liner.
3. Costs for Options 2A,2B, 3A,3B include costs for a 4 foot thick underdrain installed beneath the gypsum (installed at CUF). This represents a significant cost difference (about 20% of the total). Detailed design can address the appropriate size of the underdrain.
4. Additional costs for addressing karst issues are unknown.
5. Due to similarity between Options 2 and 3, costs developed for Option 2 are essentially the same for Option 3.
6. Costs don't include drainage features built into the stack as it develops. Closure costs are also excluded.

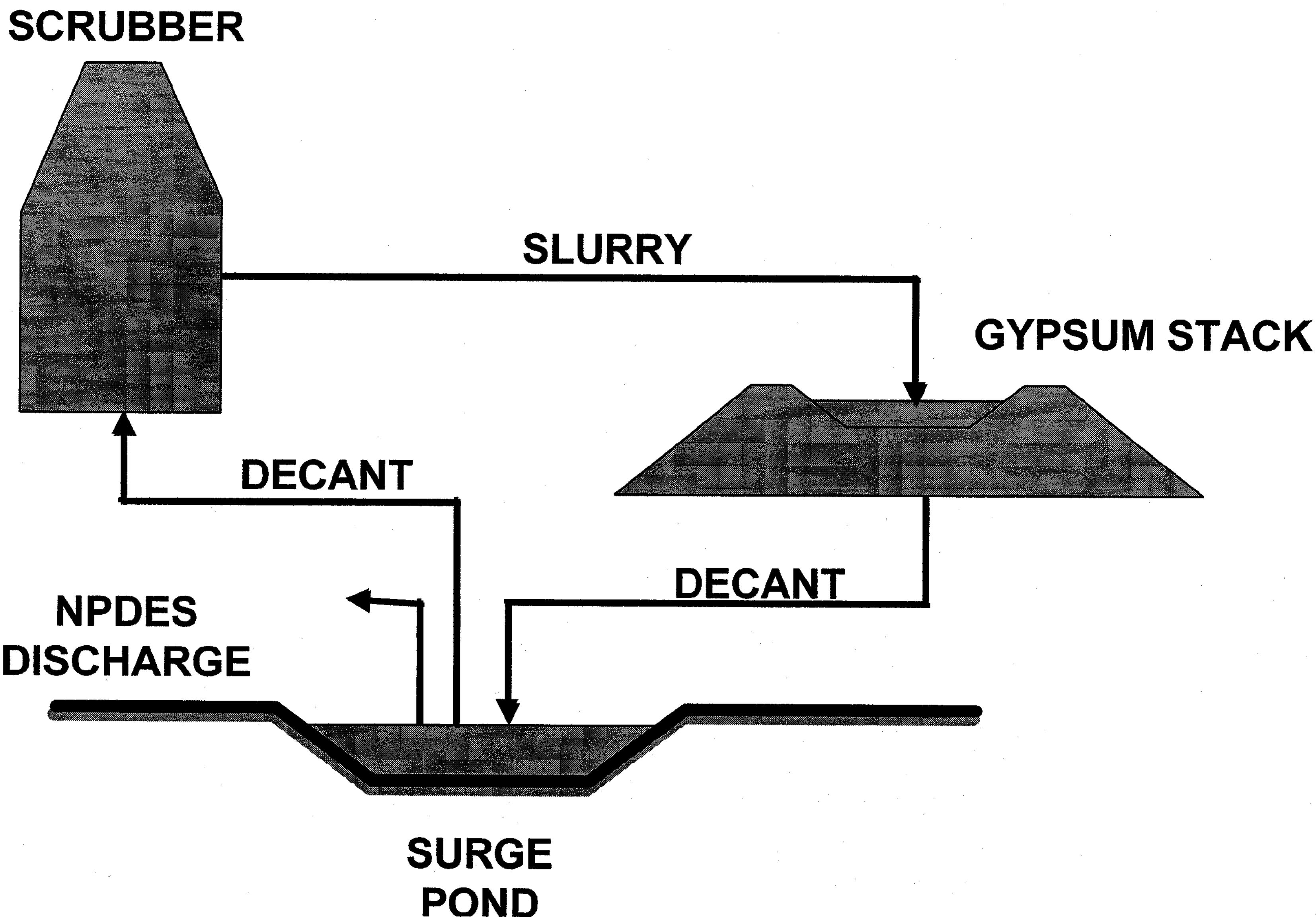
Objectives

- Develop conceptual configurations for disposal of wet and dry gypsum in concert with ash disposal (Option 3B)
- Discuss pros & cons of each configuration
- Reach consensus on a concept that is both feasible and cost effective
- Discuss dry gypsum disposal for KIF (advantages & disadvantages vs wet disposal)

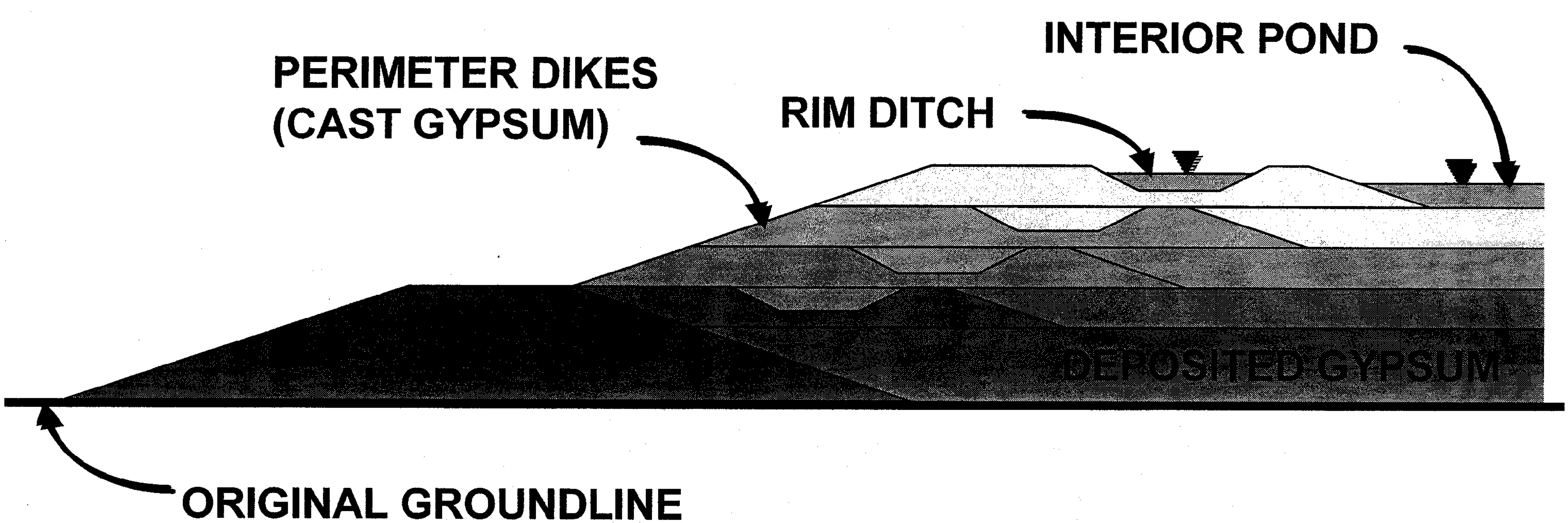
Objectives (Continued)

- Scope of work for study:
  - Develop disposal concepts
  - Develop cost basis for disposal
  - Use constraints set by TVA (i.e., develop disposal facility only, not evaluate process systems (wet vs dry).

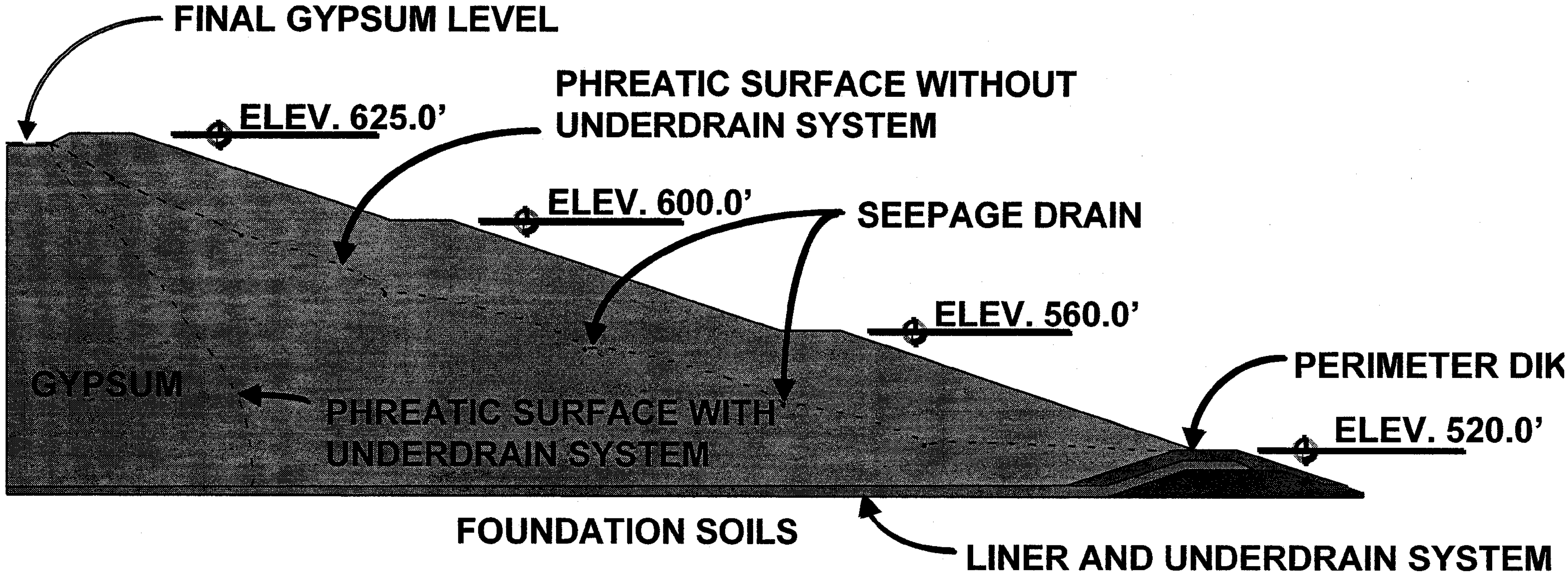
CALCIUM SULFATE DISPOSAL



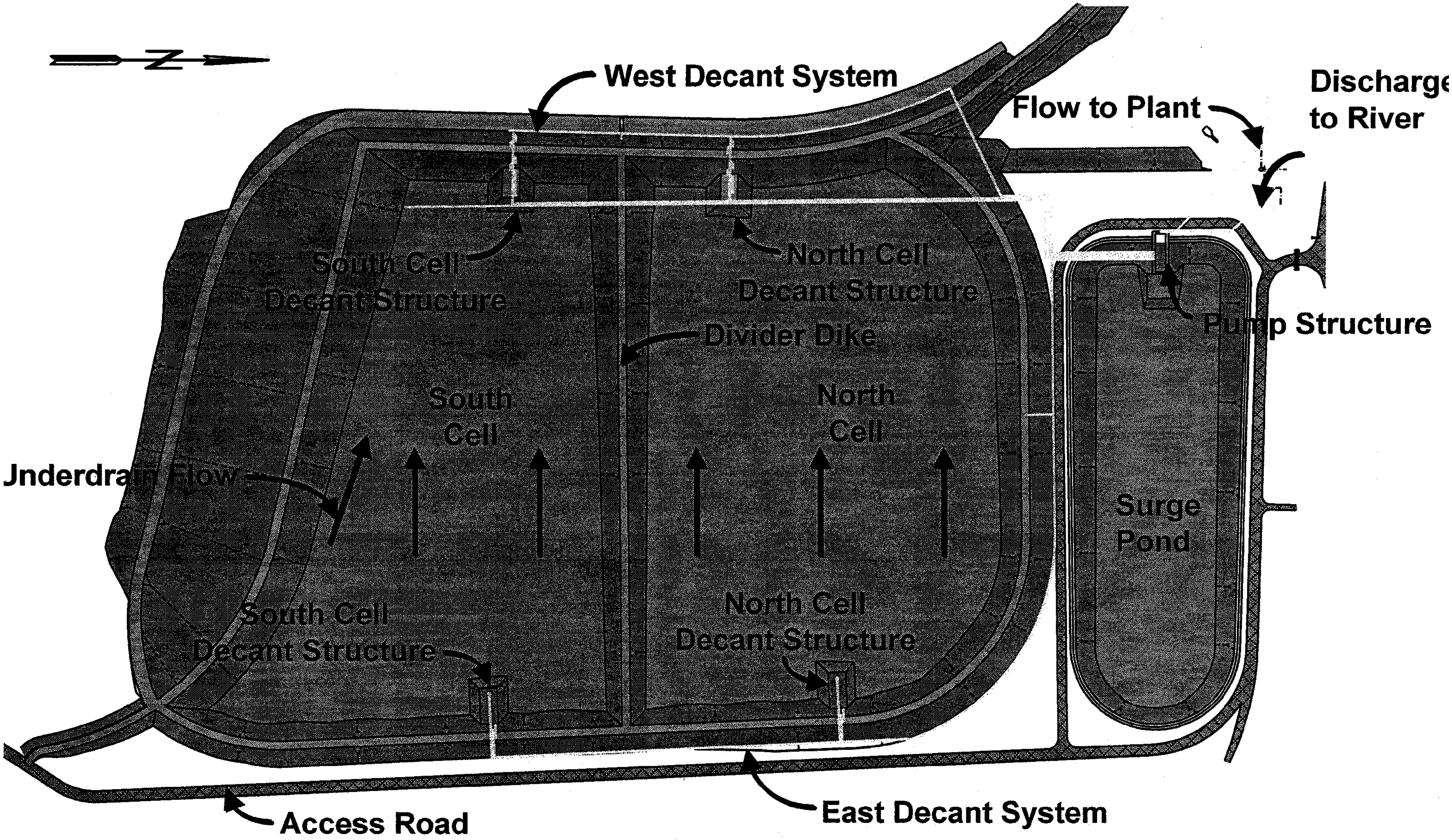
GYPSUM STACKING



SCHEMATIC DESIGN



TYPICAL DECANT SYSTEM SCHEMATIC



OPTION 3B-COMBINED GYPSUM/ASH CONCEPTS

- Concept 1 – Complete segragation
  - Advantages
    - Fluctuations of gypsum don't affect operations
    - Constant rate of ash generation allows better planning
    - Leachate streams can be segregated
  - Disadvantages
    - Fixed footprint for ash disposal does not allow flexibility for additional ash disposal, if gypsum rate is lower than projected

OPTION 3B-COMBINED GYPSUM/ASH CONCEPTS

- Concept 2 – Combined gypsum/ash disposal
  - Advantages
    - Maximizes use of area
    - Perimeter dikes are wet cast gypsum and are built during operations
    - Design can utilize outer dike (wet cast) and inner dike (can be constructed using dry ash).
    - Possibility of reducing footprint of drainage system beneath stack (must be investigated further)

OPTION 3B-COMBINED GYPSUM/ASH CONCEPTS

- Concept 2 – Combined gypsum/ash disposal
  - Disadvantages
    - Configuration is dependent on having enough gypsum to keep up with ash disposal
    - Greater dike length

CO-DISPOSAL OF WET (KIF) & DRY (BRF) GYPSUM

- Issues
  - Exterior dikes should be wet-cast
  - Truck access
  - Inner dike can be constructed with dry gypsum
  - Dry gypsum can be dumped on inner dike road and pushed into pond

NEED FOR DRAINAGE AT BASE

- Underdrain for Concept 1 Required? Revisit.
- Concept 1 - Drain materials should be compatible with leachate streams. Leachate streams can be segregated.

NEED FOR DRAINAGE AT BASE (Continued)

- Concept 2 – Strength (stability) derived from wet-cast outer shell. Footprint of drainage system within the outer dike can possibly be minimized. Slope drains in outer dikes must be properly installed to provide adequate stability.
- Clogging needs to be investigated for drainage at base of stack for both concepts.

NEED FOR DRAINAGE AT BASE (Continued)

- Seismic stability analysis required for solid waste permit (Both concepts)
- Inspections and performance monitoring is necessary to ensure success
- Use of piezometers and outlet flow measurements for data collection to monitor performance. Performance measurements are relatively simple to perform.

CONSENSUS

- Wet-cast gypsum dikes are feasible at base, in lieu of earthen dikes (saves 26% of capital costs)
- For wet ash and gypsum disposal, mixing ash and gypsum during sluicing is not desirable. Wet-cast gypsum dikes perform much better than mixed gypsum/ash.
- Ash and gypsum can be mixed as described for Concept 2.

CONSENSUS

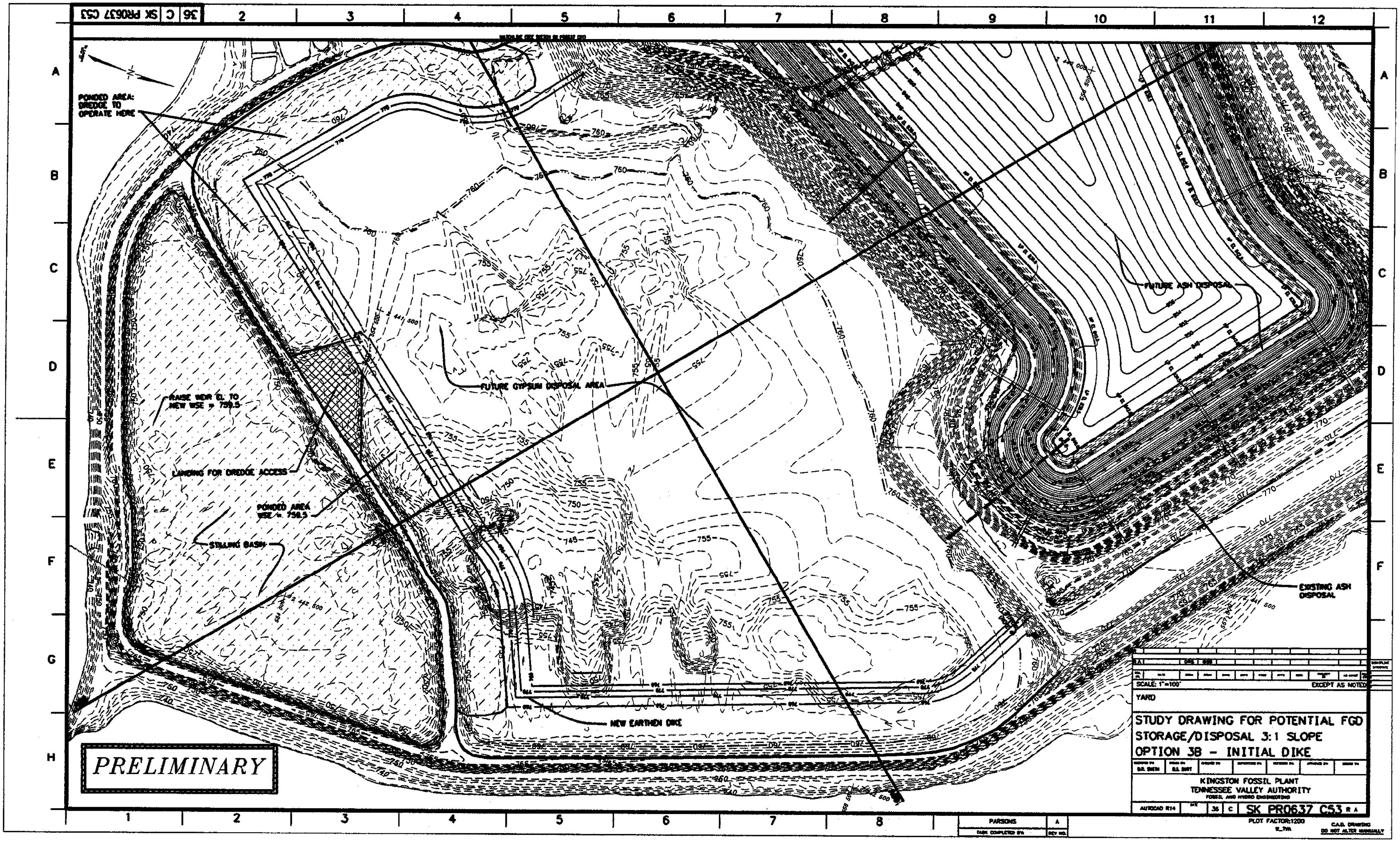
- Mixing dry gypsum and dry fly ash is ok
- Once mixed, neither material is marketable
- Materials will consolidate differently (gypsum much faster than ash). This is a design consideration
- Addition of gypsum to pond disposal may or may not increase free water volume requirement. Needs to be investigated further.

CONSENSUS

- Addition of gypsum to pond disposal may or may not increase free water volume requirement. Needs to be investigated further.
- Ash pond location is viable, pending confirmation of stability parameters
- Clogging tests for both gypsum-only disposal and combined ash-gypsum need to be performed

WET VS DRY GYPSUM DISPOSAL

TOPIC	WET	DRY
Dewatering	None	Required (belt filter)
Transport	Hydraulic (low operating cost)	Conveyor or truck plus loading and spreading (higher cost)
Surface water runoff	Surge pond part of facility	Need surge pond
Dusting	Minimal, but depends on water content of gypsum	Need dedicated water truck
Earthquake	Significant design issue, due to higher phreatic surface	Less of concern
Free water volume	Stormwater/process water regulated by NPDES and solid waste permit	Stormwater regulated by solid waste permit
Density	Lower compared to dry gypsum disposal	Higher, when compacted in thin lifts (lower when dumped
Harvesting	Requires 2 ponds	Easily performed



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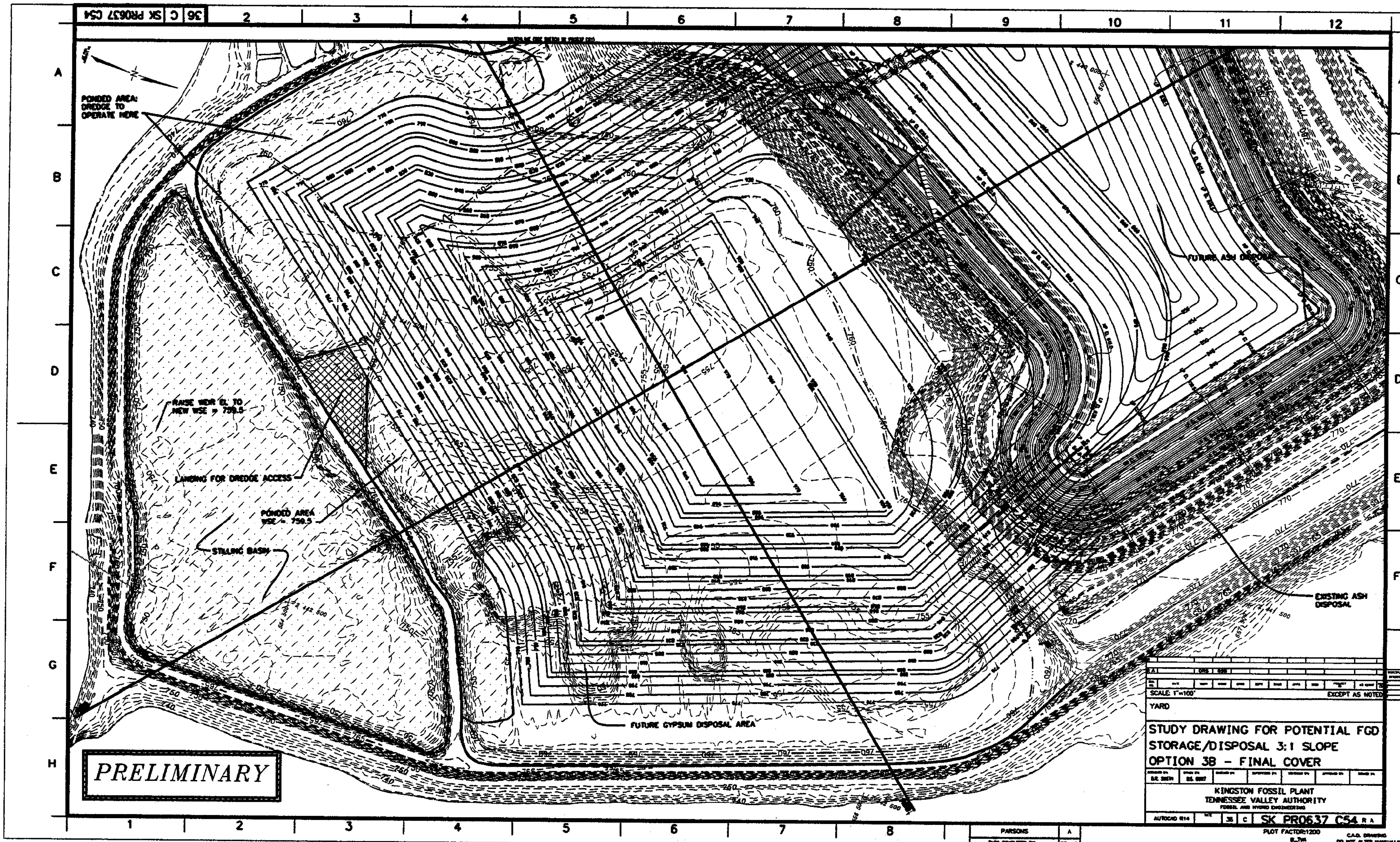

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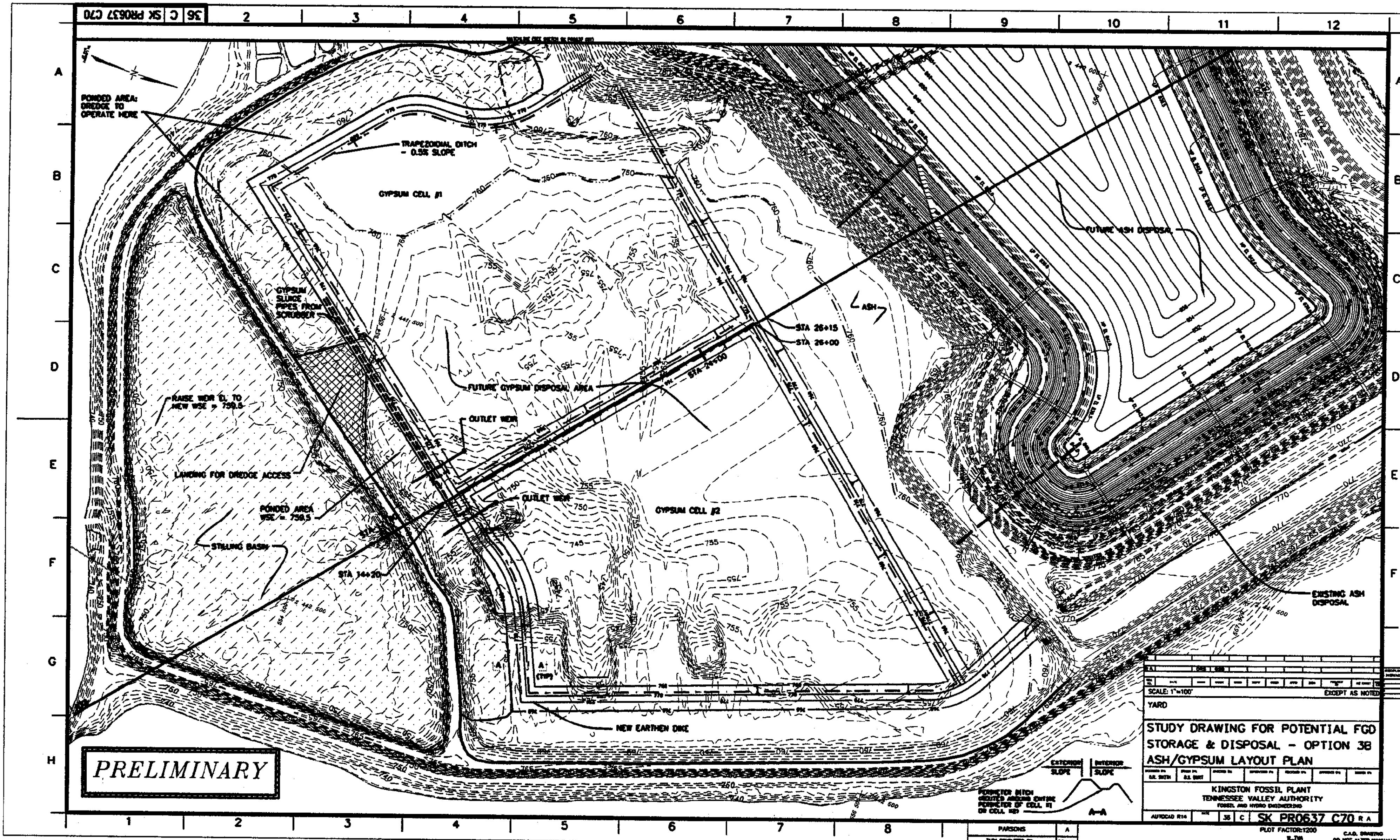

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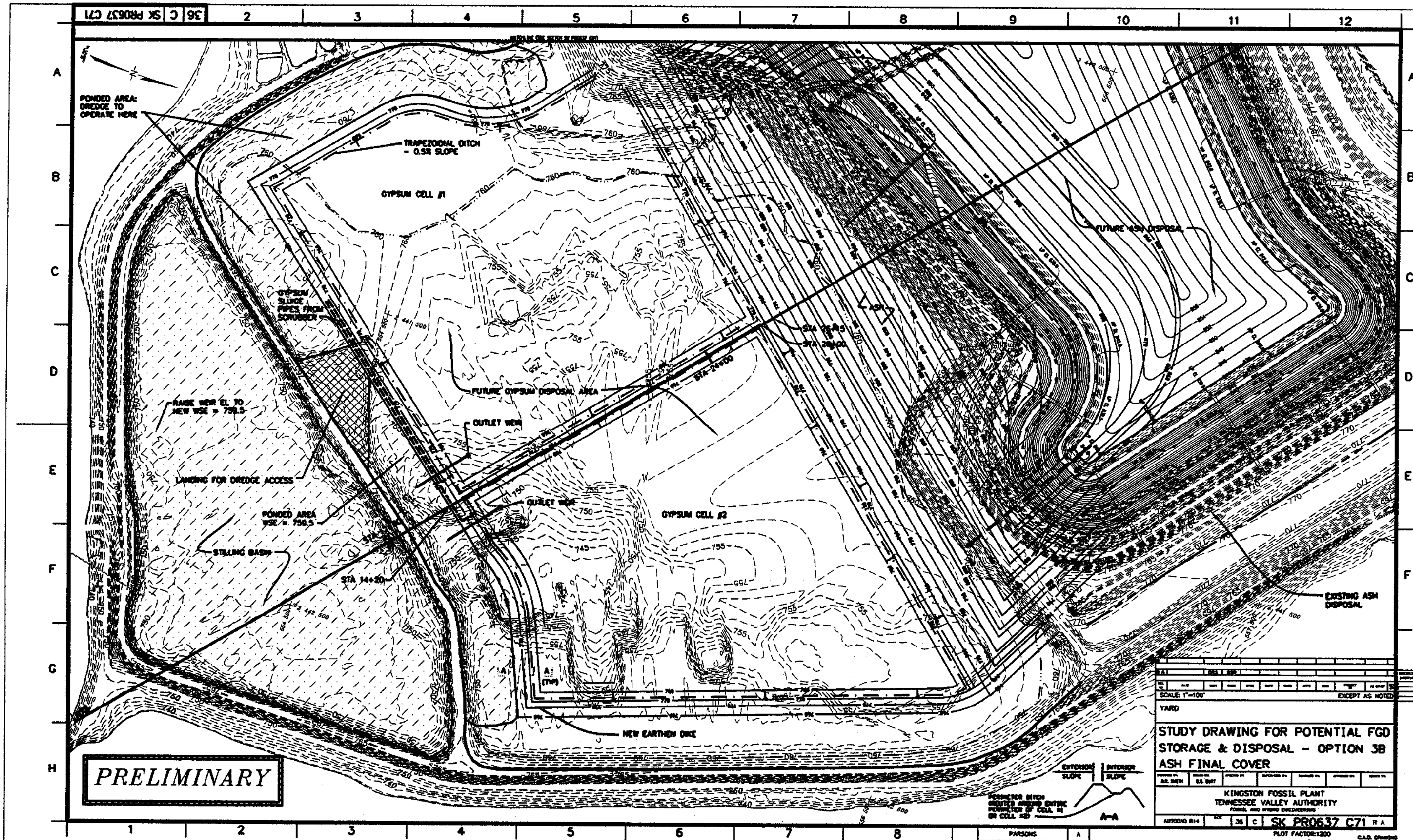

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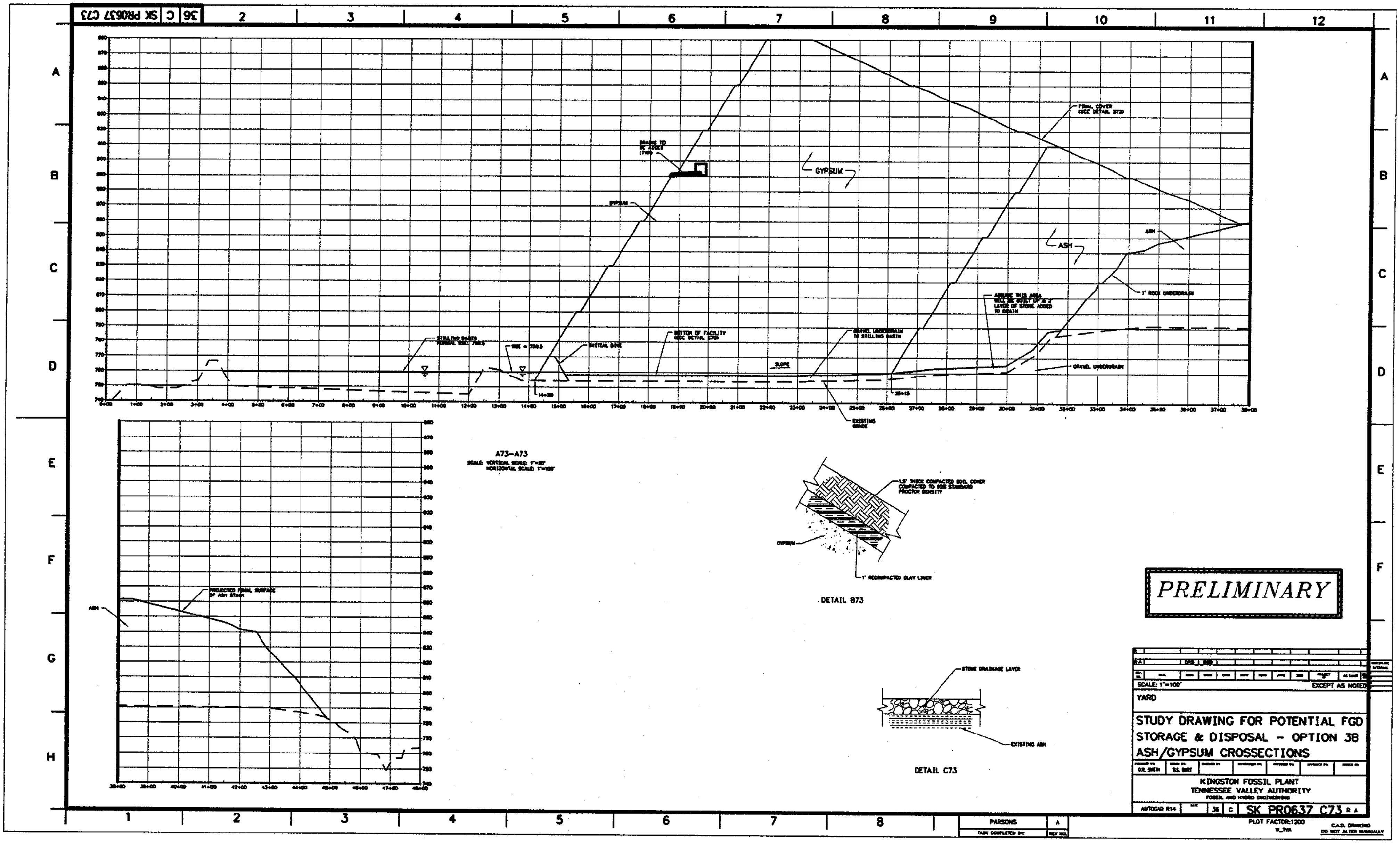

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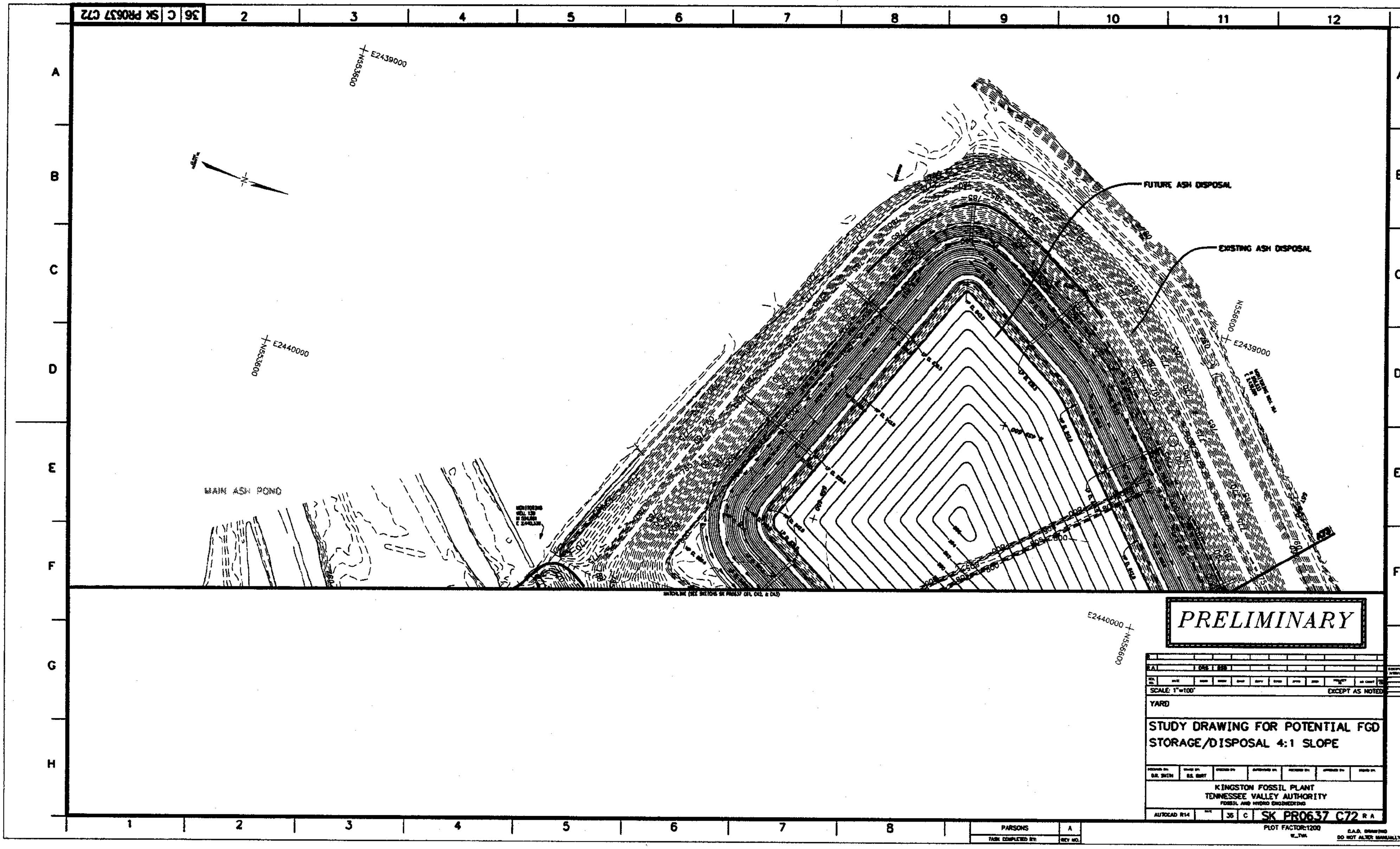

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