

DUSEL Workshop

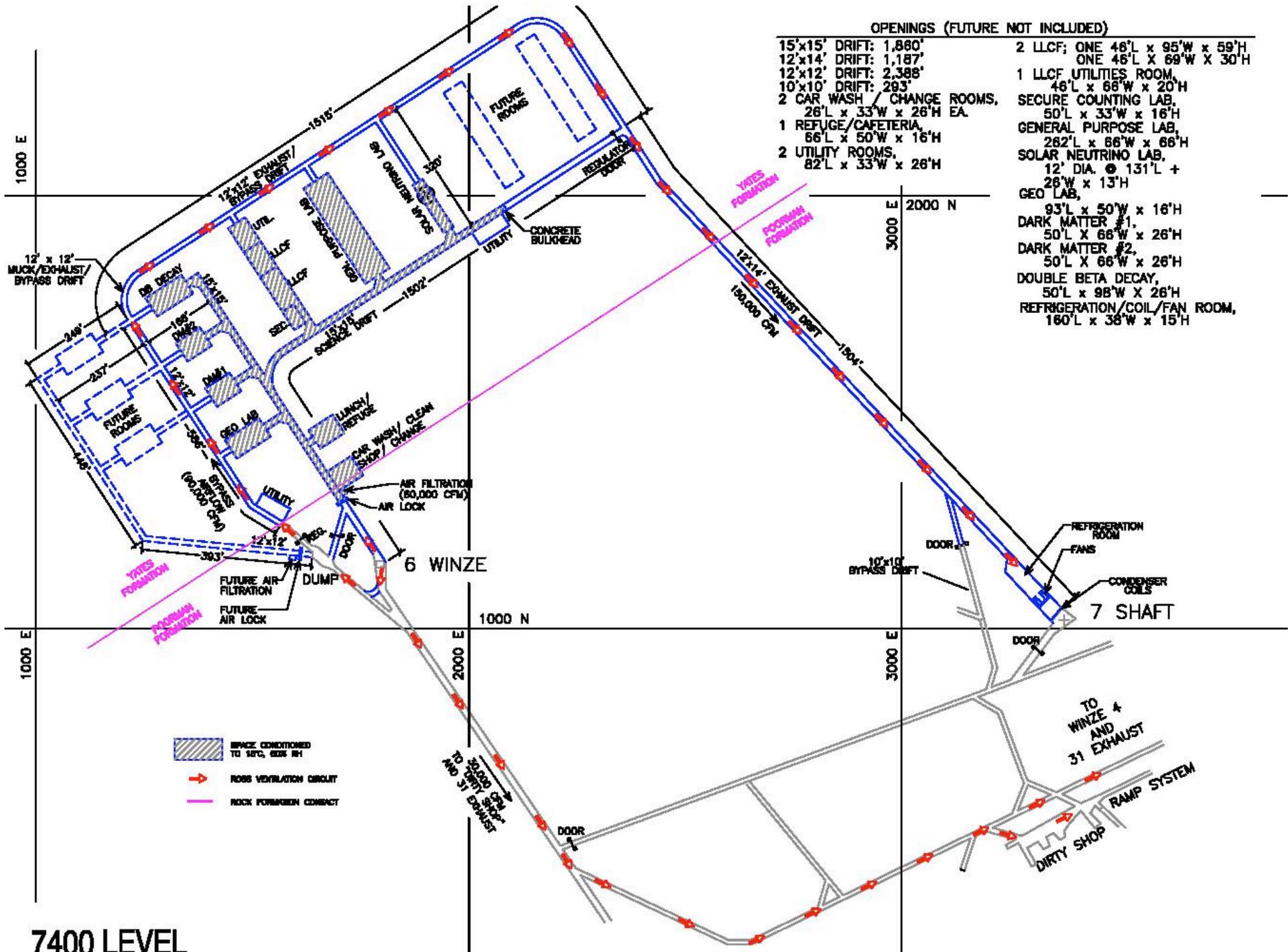
Laboratory Layout

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CNA Consulting Engineers

Session Objectives

- Educate
 - Typical layouts
 - Design rules-of-thumb
 - Design process
- Learn
 - Compatibilities
 - Incompatibilities
 - Timeline issues
 - Sequence, expansion, remodeling

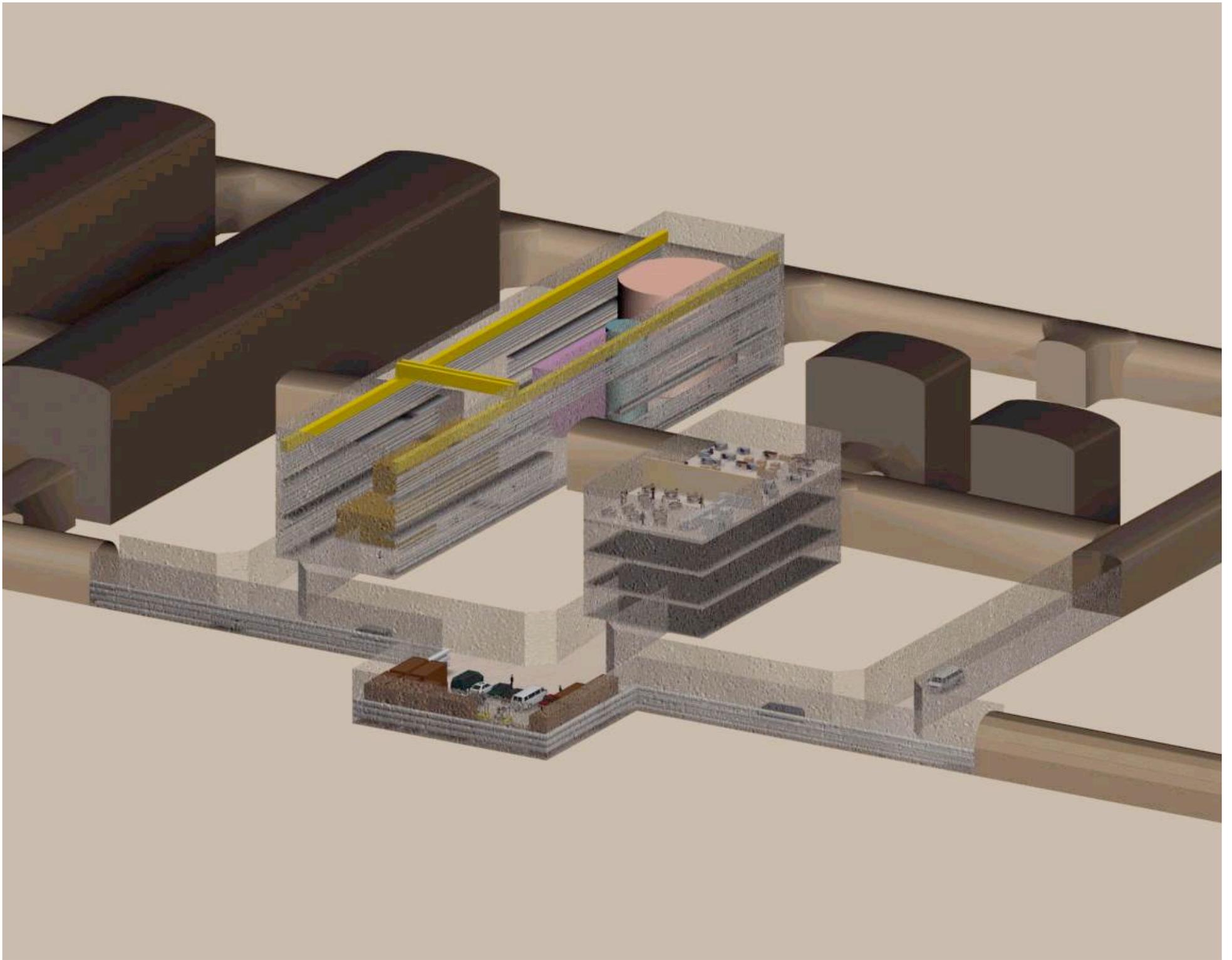


OPENINGS (FUTURE NOT INCLUDED)

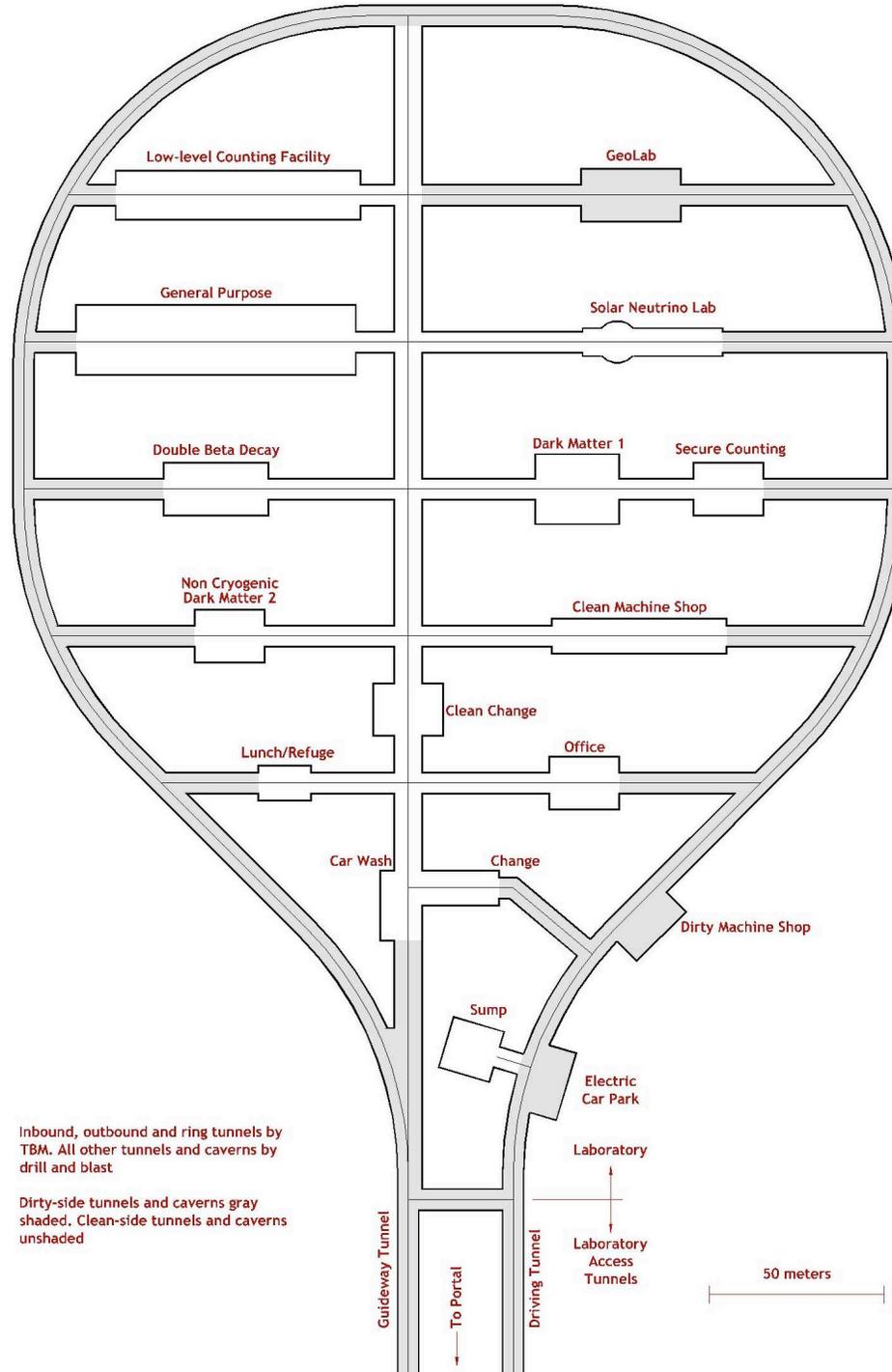
- 15'x15' DRIFT: 1,860'
- 12'x14' DRIFT: 1,187'
- 12'x12' DRIFT: 2,388'
- 10'x10' DRIFT: 293'
- 2 CAR WASH / CHANGE ROOMS, 26'L x 33'W x 26'H EA.
- 1 REFUGE/CAFETERIA, 66'L x 50'W x 16'H
- 2 UTILITY ROOMS, 82'L x 33'W x 26'H
- 2 LLCF; ONE 46'L x 95'W x 59'H, ONE 46'L x 69'W x 30'H
- 1 LLCF UTILITIES ROOM, 46'L x 66'W x 20'H
- SECURE COUNTING LAB, 50'L x 33'W x 16'H
- GENERAL PURPOSE LAB, 262'L x 66'W x 66'H
- SOLAR NEUTRINO LAB, 12' DIA. @ 131'L + 26'W x 13'H
- GEO LAB, 93'L x 50'W x 16'H
- DARK MATTER #1, 50'L x 66'W x 26'H
- DARK MATTER #2, 50'L x 66'W x 26'H
- DOUBLE BETA DECAY, 50'L x 98'W x 26'H
- REFRIGERATION/COIL/FAN ROOM, 160'L x 38'W x 15'H

- SPACE CONDITIONED TO 18°C, 60% RH
- ROSS VENTILATION CIRCUIT
- ROCK FORMATION CONTACT

7400 LEVEL



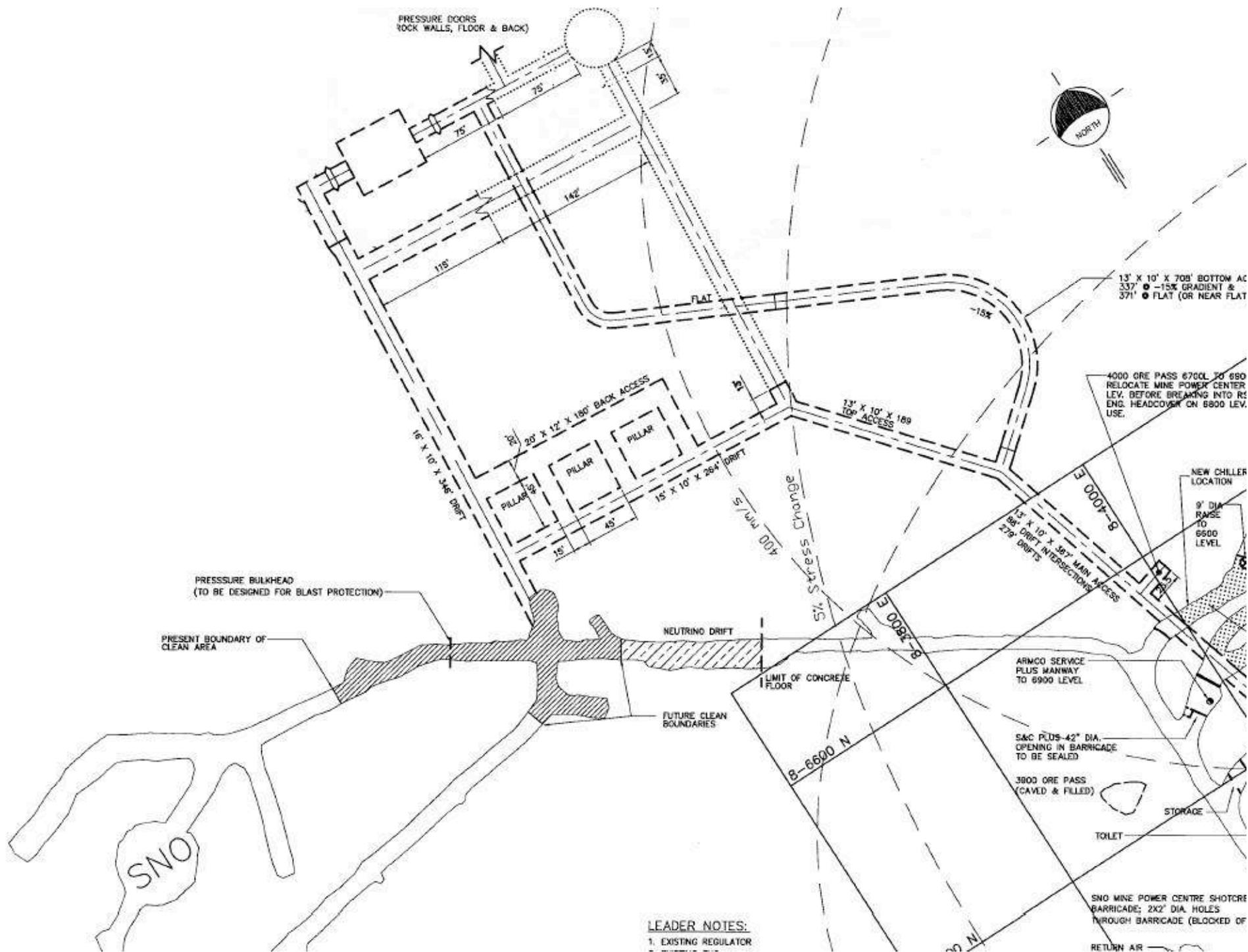
Icicle Creek NUSL - Preliminary Underground Layout



Inbound, outbound and ring tunnels by TBM. All other tunnels and caverns by drill and blast

Dirty-side tunnels and caverns gray shaded. Clean-side tunnels and caverns unshaded

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PRESSURE DOORS
ROCK WALLS, FLOOR & BACK)



13' x 10' x 708' BOTTOM AC
337' ● -15% GRADIENT &
371' ● FLAT (OR NEAR FLAT)

4000 ORE PASS 670CL TO 680
RELOCATE MINE POWER CENTER
LEV. BEFORE BREAKING INTO RE
ENG. HEADCOVER ON 6800 LEV.
USE.

NEW CHILLER
LOCATION

9' DIA
RAISE
TO
6600
LEVEL

PRESSURE BULKHEAD
(TO BE DESIGNED FOR BLAST PROTECTION)

PRESENT BOUNDARY OF
CLEAN AREA

NEUTRINO DRIFT

FUTURE CLEAN
BOUNDARIES

LIMIT OF CONCRETE
FLOOR

ARMCO SERVICE
PLUS MANWAY
TO 6900 LEVEL

SAC PLUS 42" DIA.
OPENING IN BARRICADE
TO BE SEALED

3800 ORE PASS
(CAVED & FILLED)

STORAGE

TOILET

SNO MINE POWER CENTRE SHOTCRE
BARRICADE; 2X2' DIA. HOLES
THROUGH BARRICADE (BLOCKED OF

RETURN AIR

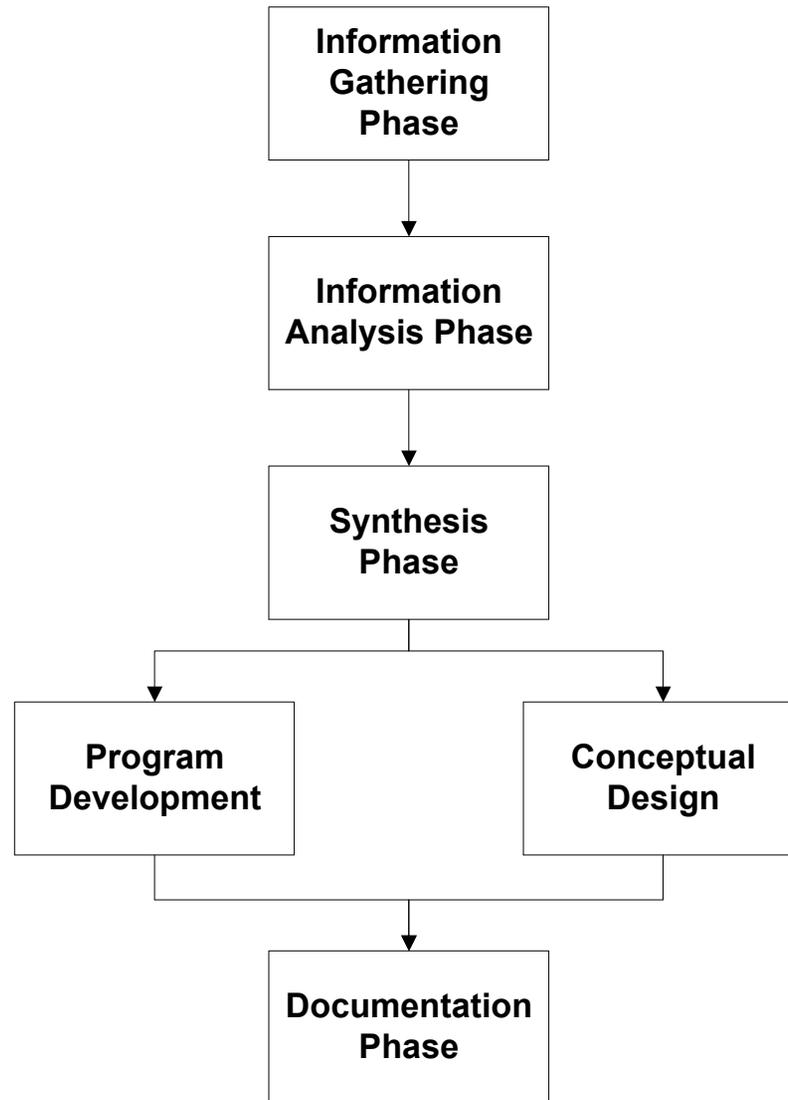
LEADER NOTES:

1. EXISTING REGULATOR

Design Rules-of-Thumb

- Rules-of-thumb
 - Initial guidelines
 - There are always exceptions
- Examples
 - Relative cost– small, shallow, compact
 - Be flexible regarding orientation & locations
 - Don't challenge the rock
 - Dry, stable excavation ~ 50 %
 - Infrastructure ~ 50 %

Process



Sequence

- Collect Technical Requirements (matrix)
 - Comprehensive
- Identify Primary TR
 - Top ten list
- Identify TR Relationships
 - Synthesize top ten list
- Relationship Matrix
 - Illustrates compatibilities and incompatibilities
- Relationship Diagramming
 - Illustrates spatial relationships

Technical Requirements Matrix

Experiment	Depth / Shielding (mwe)	Space, area or volume (m ² or m ³) l*w*h unless specified	Radon Background (mBq/m ³)	Occupancy	Hazardous Materials	Crane	Chilled Water	Ventilation	Stable Temp. (A/C Reqd.)	Electrical Power (kW)	"Clean" Areas (class)
General solar neutrino	2500 to 4500	500 to 27000 m ³	<10 to < 1		Flammable gases, cryogenic liquids (Ne, He, N)					300	
MOON	>2500	11x8x6	10		Toxic, flammable liquids/cryogens					80	Yes
LENS	>3800	16x16x16	1		Flammable scintillation materials					250	Yes
HYBRID	7000	80x18x19	None		None					Modest	No
HERON	4500	7m radius, 20m high cyl.	None		Large volume cryogens					600 Peak, 125 Avg.	Yes
CLEAN	4500	4.5m radius, 20m high cyl.	None		Large volume cryogens					100 Avg.	Yes

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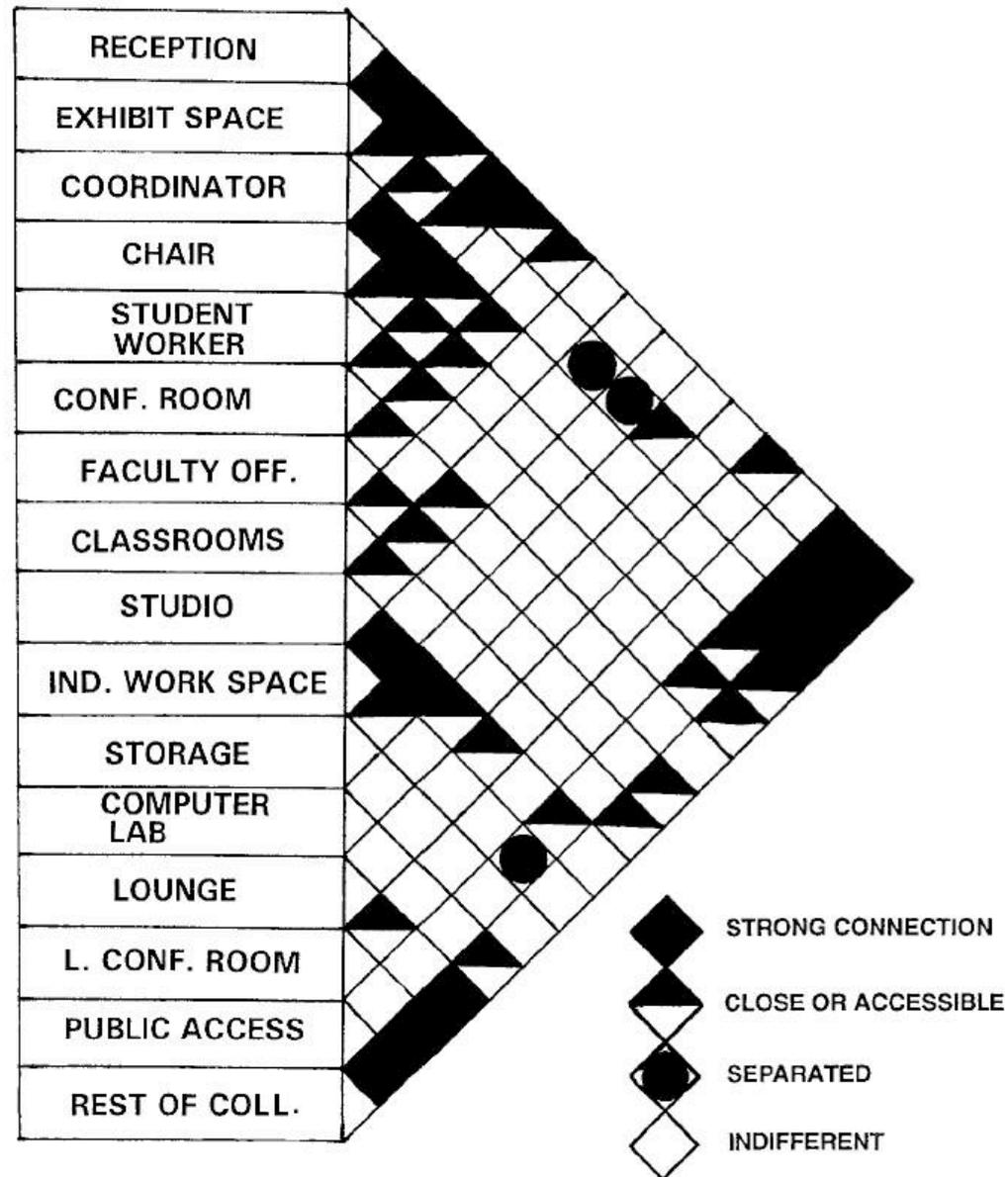
DUSEL Space Characteristics

- Low background
- Development
- Prototype
- Large caverns
- Deep caverns
- Clean spaces
- Cryogenic spaces
- Large rock volumes
- Uncontaminated rock
- Seismic noise sensitive
- Cause rock damage
- High-purity water
- Cryogen infrastructure

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- Collect Technical Requirements (matrix)
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- **Relationship Matrix**
 - **Illustrates compatibilities and incompatibilities**
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Relationship Matrix

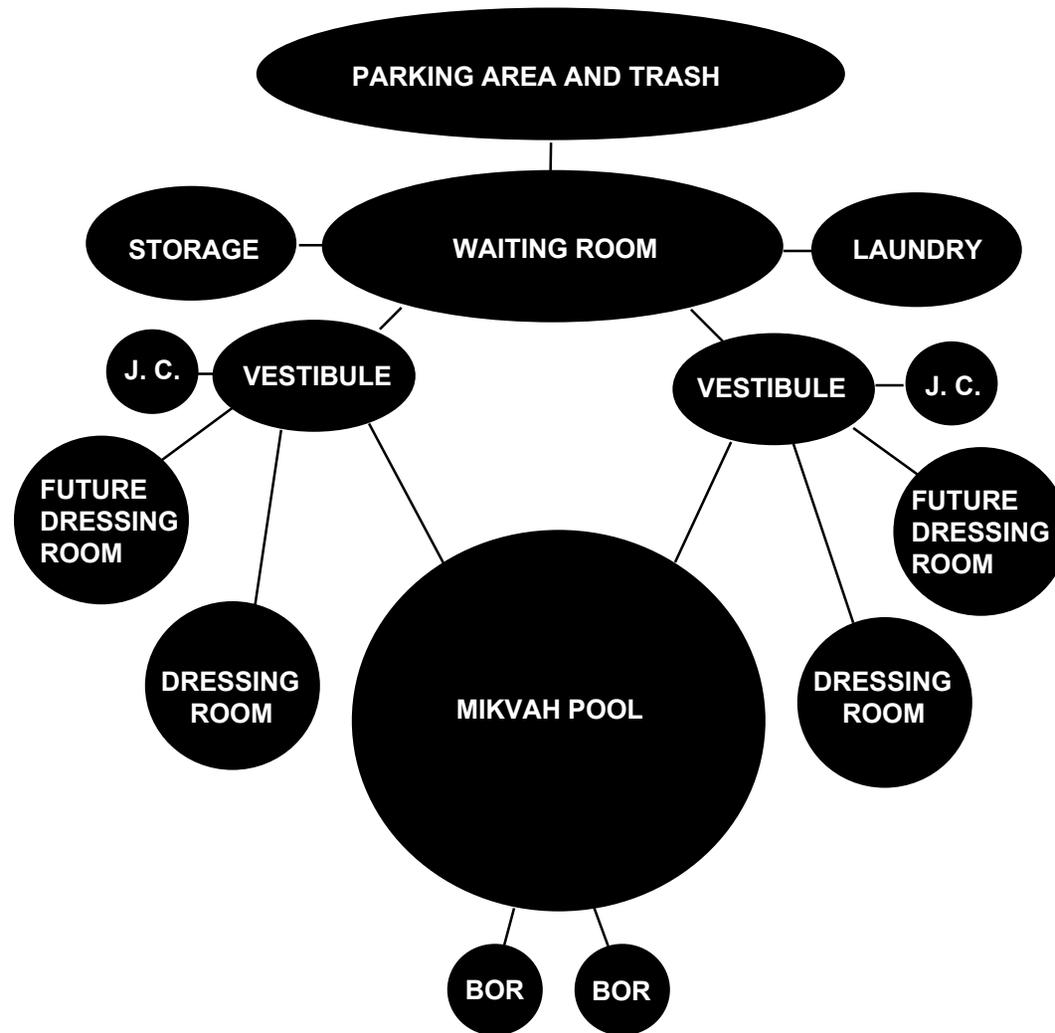


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Relationship Diagram



Session Objectives

- Compatibilities
- Incompatibilities
- Targets of opportunity
- Timeline issues
 - Sequence, expansion, remodeling

Compatibilities

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Incompatibilities

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Timeline Issues

- Sequence, expansion, remodeling
- Characterization
 - Necessary for design
 - Integration with Geo & Bio science program
- Shared or single purpose caverns
- Funding profile
- Shared use of accessways
 - Experiment operations & new construction



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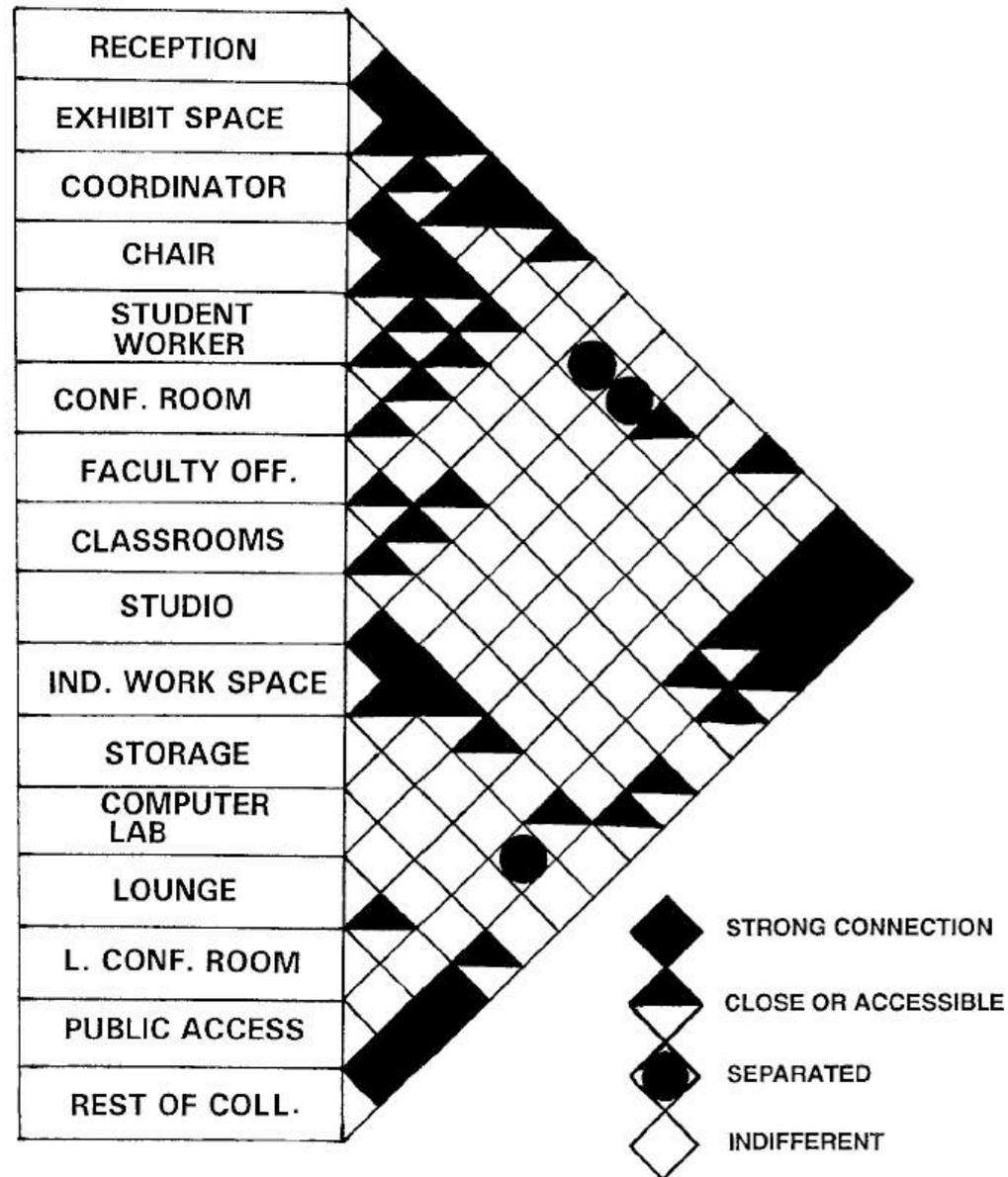
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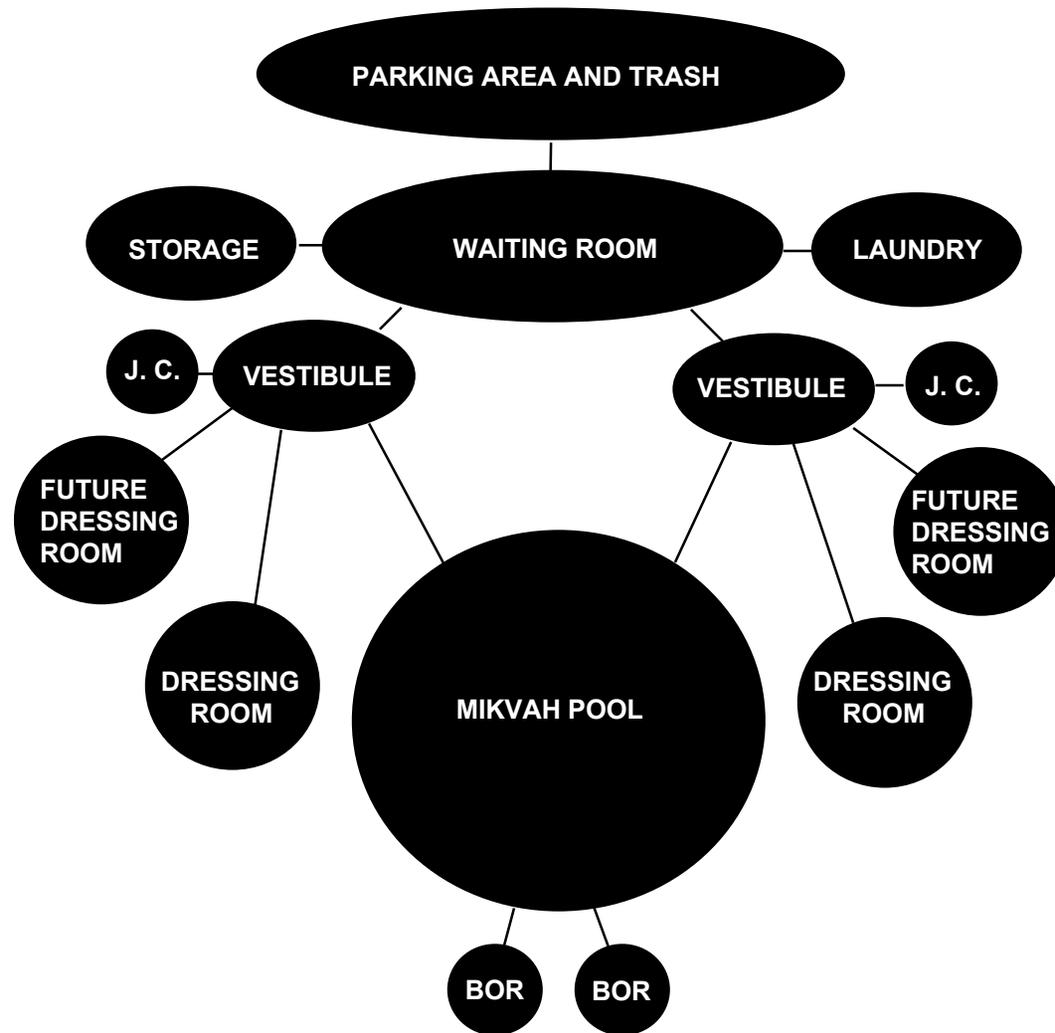
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Relationship Matrix



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Relationship Diagram



Lab Layout Key Points

- Information verification
- Multiple vs shared caverns
- Accelerator incompatibilities
- Cleanliness
- Earth science input
- 3D access for bio/geo/eng
 - Multiple depth—compatible or incompatible
- Timeline
 - Site characterization /review process

Surface Facilities

- Admin/conf/office
- Visitor ctr/classroom
- Assembly space
- Labs (chem, bio, rock)
- Mat'l handling/storage
- Computer/data hubs
- Library/media ctr
- Lodging/housing
- Med/clinic
- Mech/electrical rooms
- Utility connections
- Core storage
- Support equip
- Rock disposal, etc.

UG Support Services

- Admin/offices
- Locker/break/cafeteria
- Storage
- Computer/data hubs
- Class rooms
- Fab/machine shop
- Mech/elec rooms
- Med/clinic
- Refuge area
- Observation gallery
- Labs