Susitna Hydro Evaluation Project

Seminar on the Development of Large Hydroelectric Projects with a Focus on the Susitna Project

presented to

Alaska Energy Authority

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HDR Alaska

DTA

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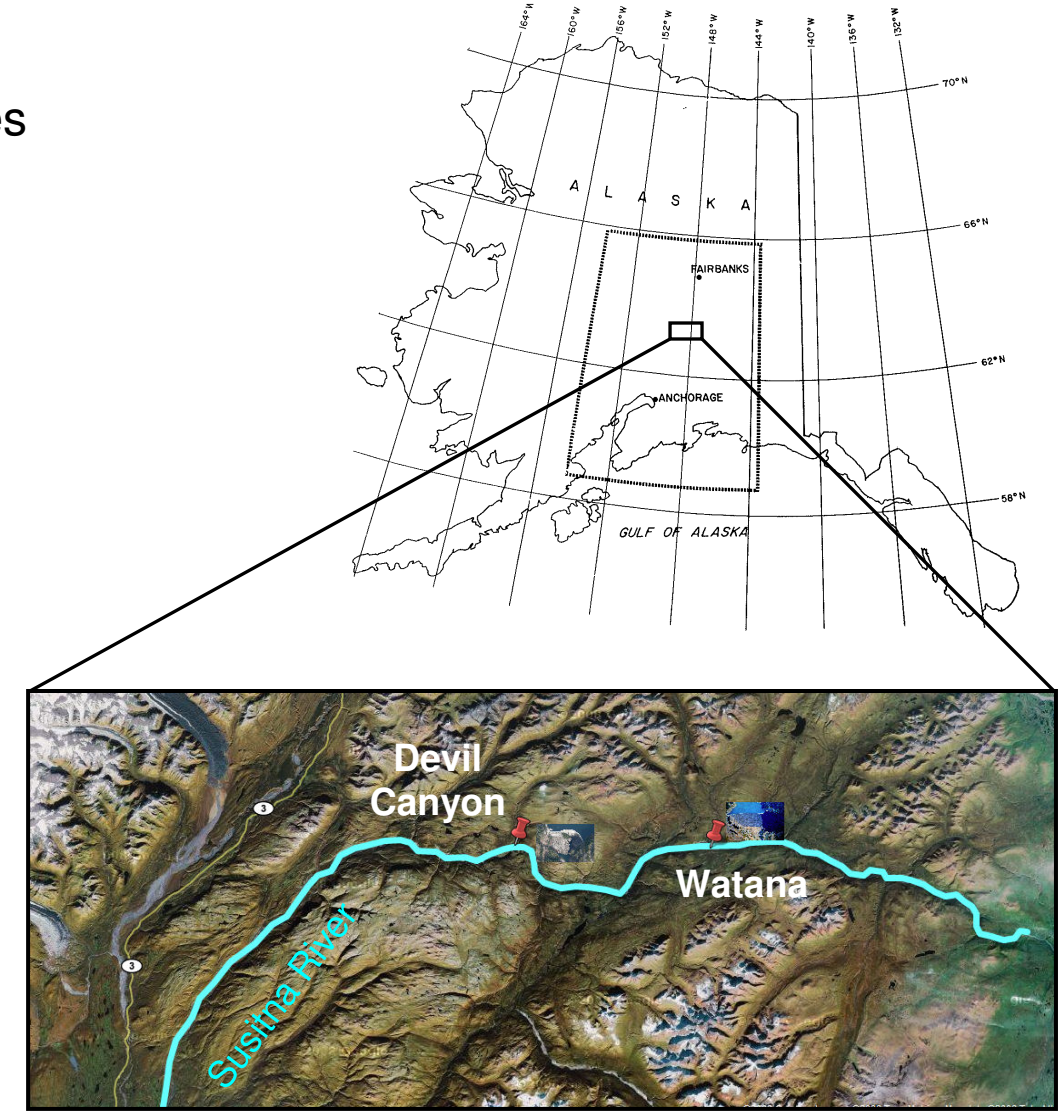
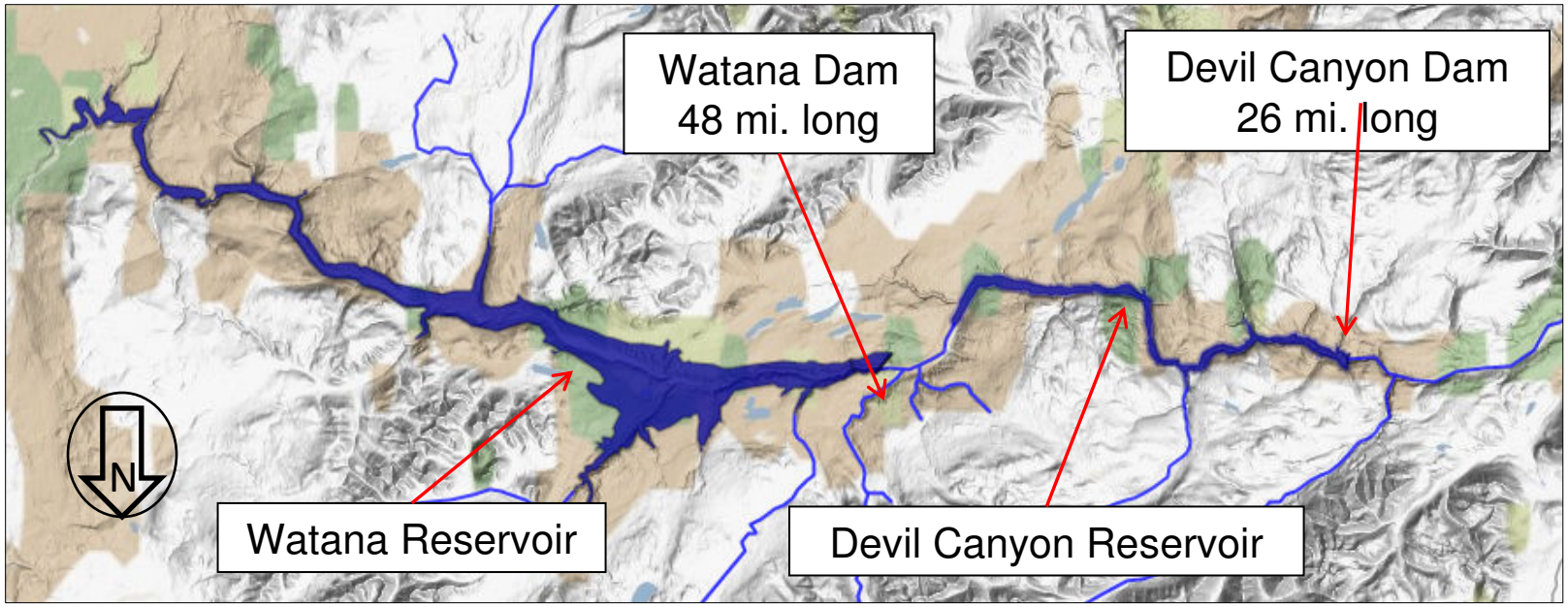
Susitna Project
Civil Works Considerations

Susitna Project - Civil Works

- Dams and related facilities
  - Spillways
  - Powerhouses
  - Tunnels
  - Intakes & outlets
  - Construction camps and villages
- Infrastructure
  - Roads and bridges
  - Rail
  - Airports
- Stage options

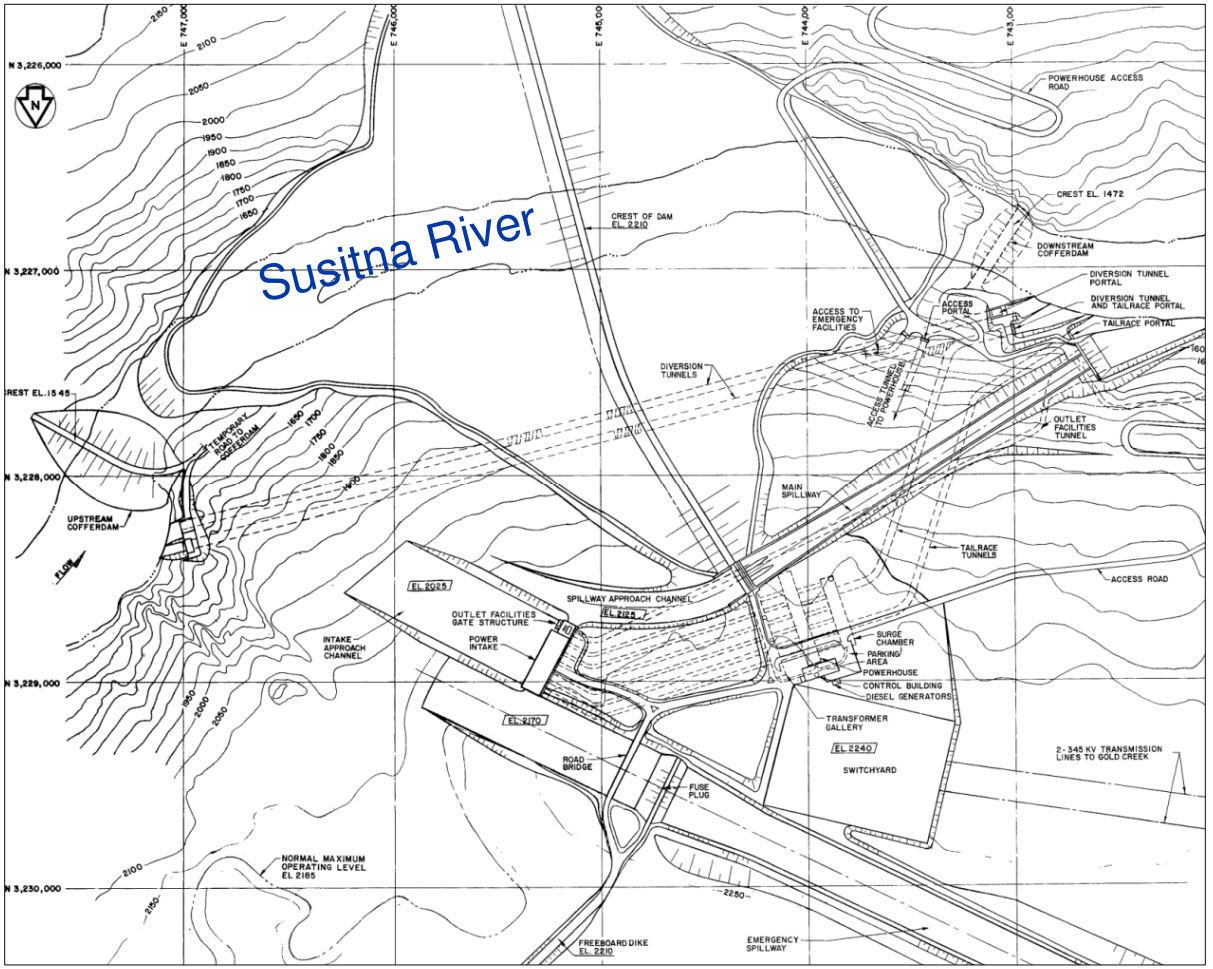


Watana and Devil Canyon Dams and Reservoirs



Watana Dam

- Rock-fill, gravity dam
- 885 feet tall
- 4,100-foot crest length



Watana Project Characteristics

- Underground power facilities with 600-foot rockfill dam
- Dam structure: Height – 885 feet
  Crest length – 4,100 feet
- Diversion of flow during construction by two 30-foot tunnels
- Underground power facilities with six 200-MW generators
- Spillway capacity: 115,000 cfs + fuse plug 140,000 cfs

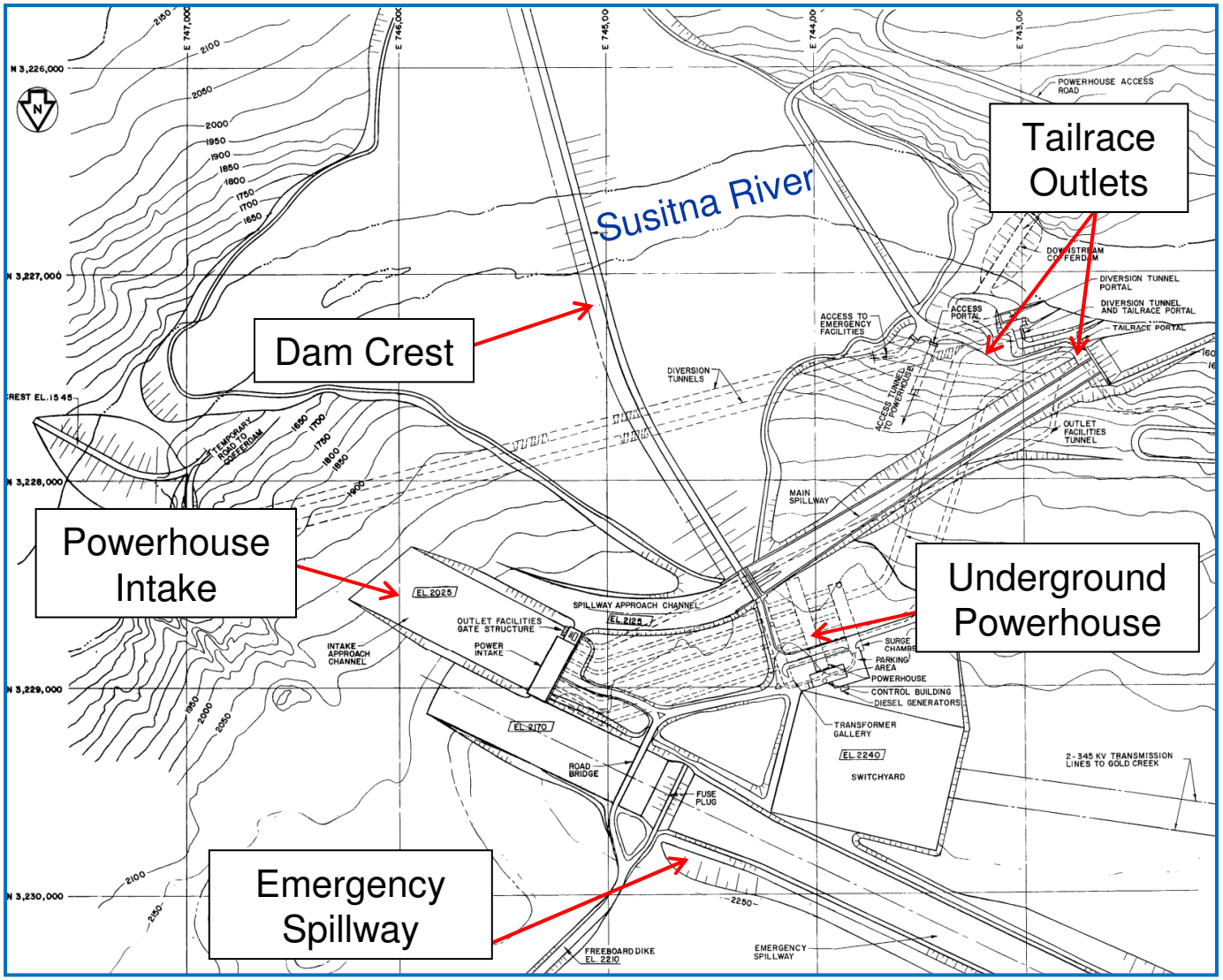
Rock-fill Embankment Dams

- Considerably more massive than arch or buttress dams but constructed with lower unit-cost materials
- Rely on weight of dam for stability and structural mass to impound water

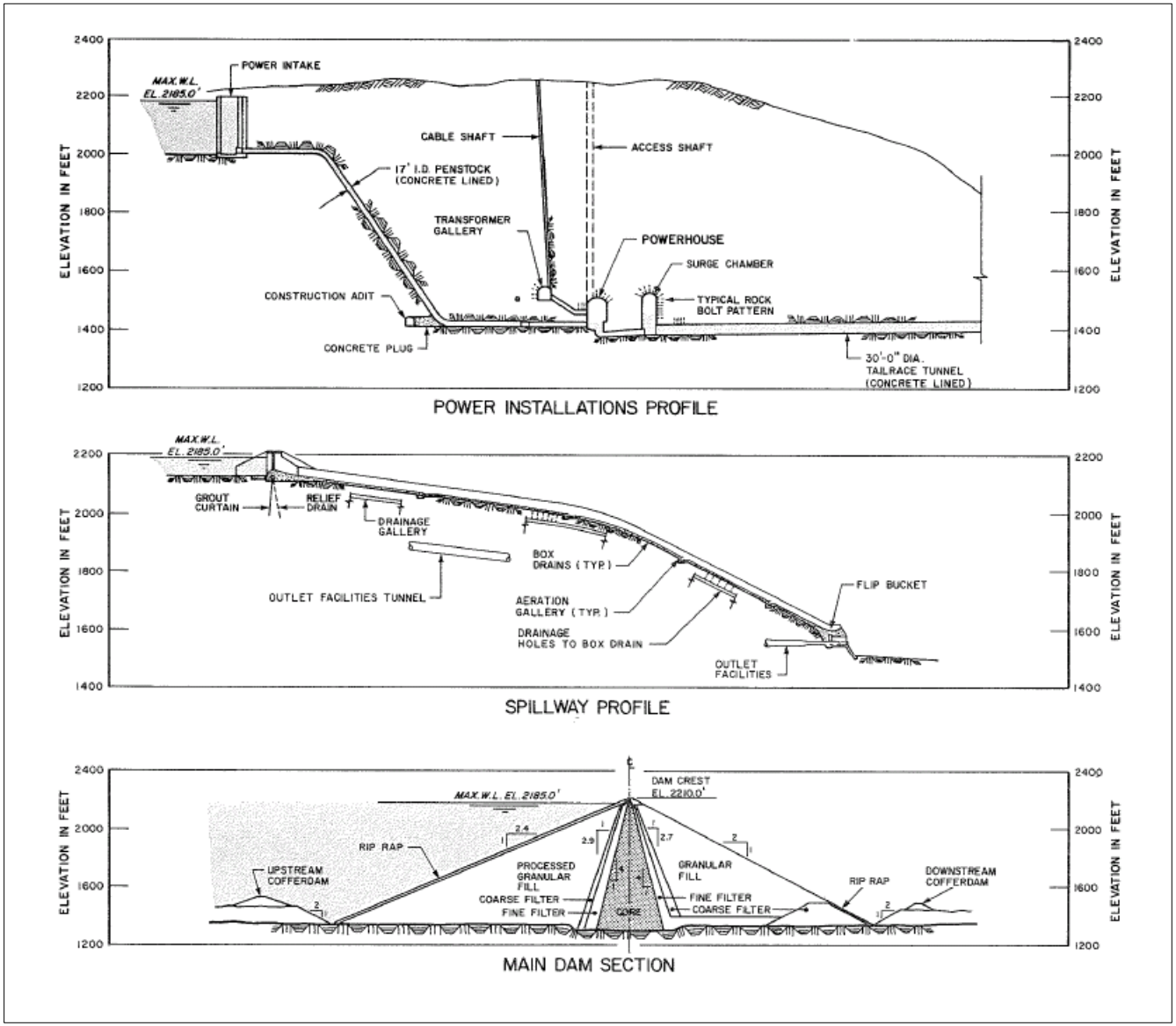
Mohle Dam, Lesotho

Oroville Dam, California

Project Layout: Watana

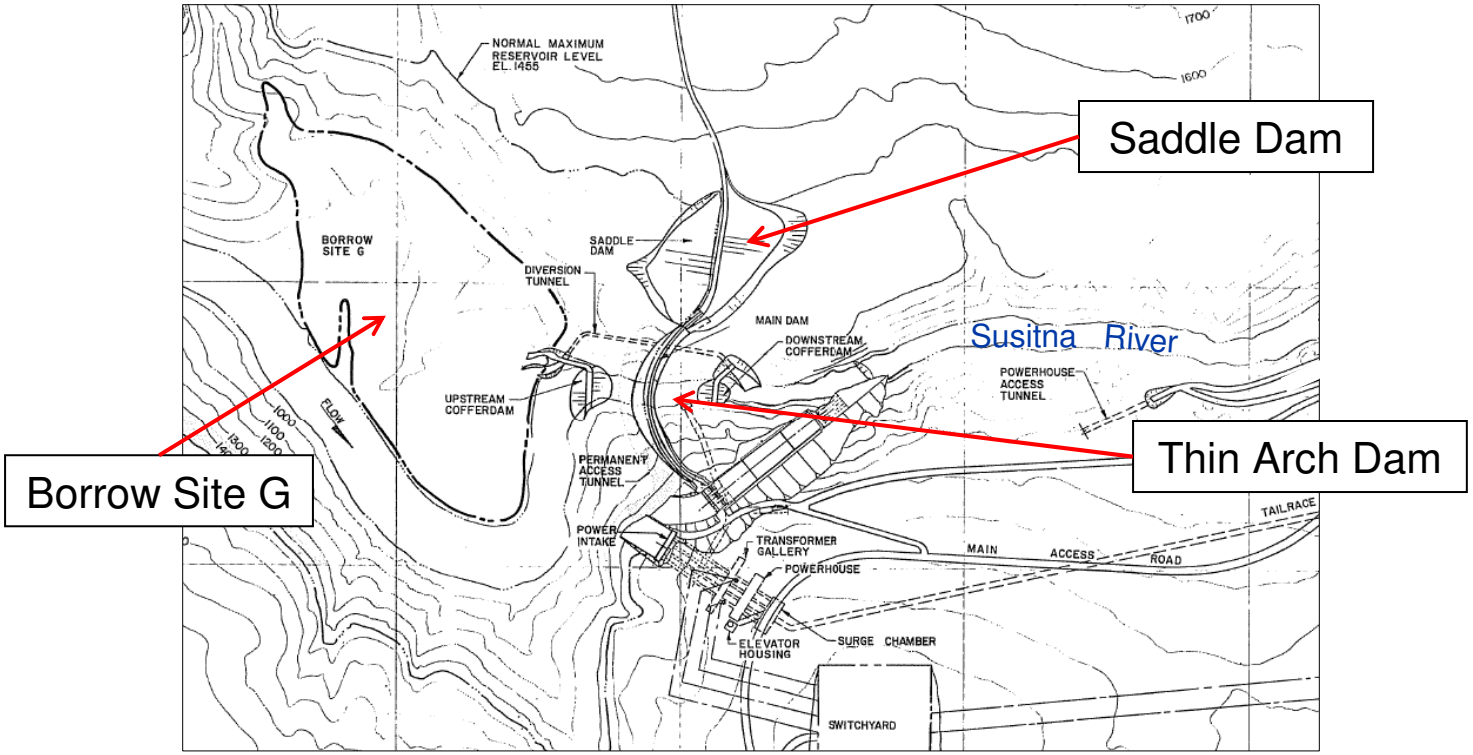


Watana Details

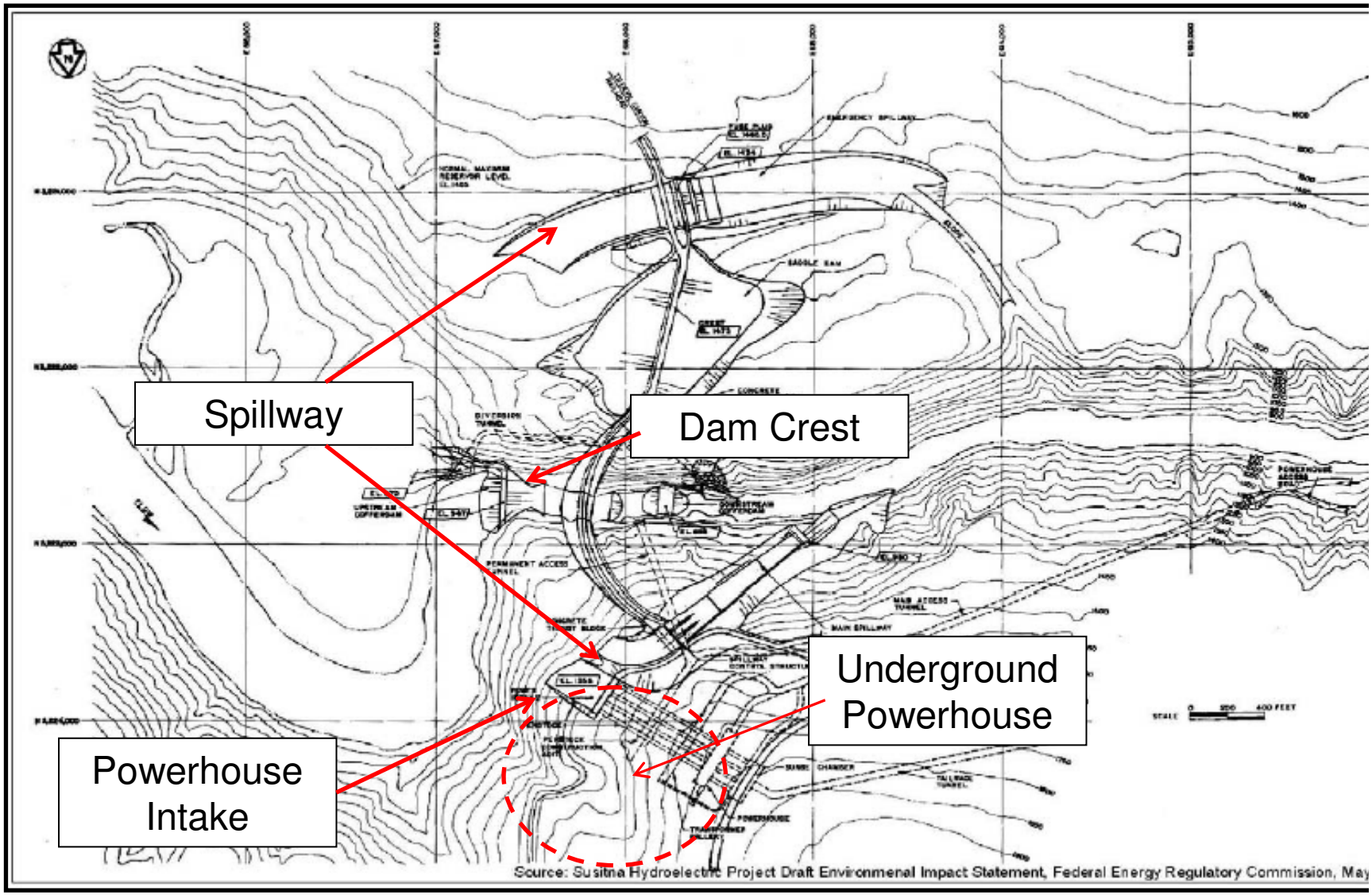


Devil Canyon Dam

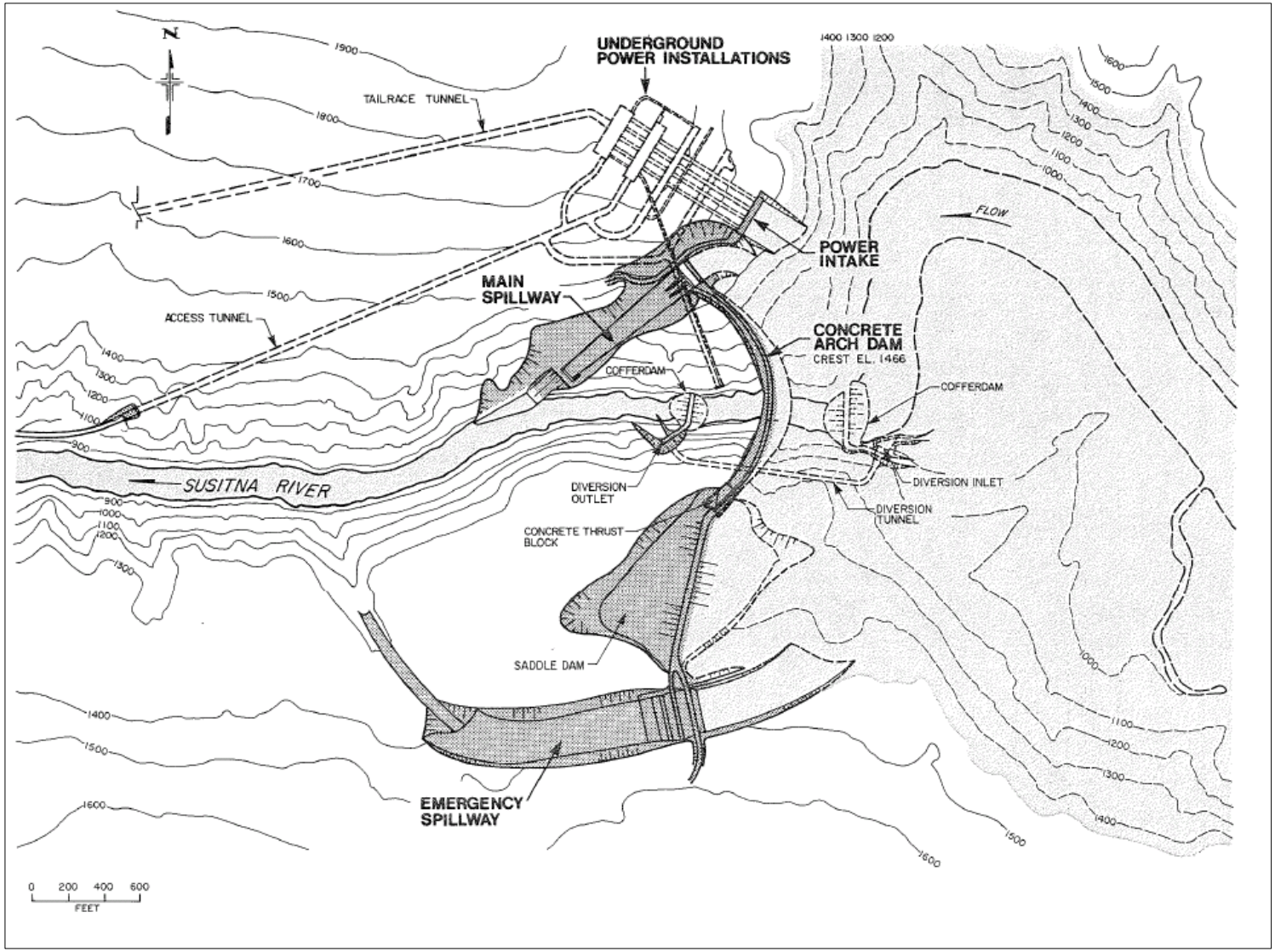
- Arch concrete dam
  - 646 feet tall above foundation
  - 1,260-foot crest length
- Earth and rockfill saddle dam
  - 245 feet tall
  - 950-foot crest length
- Located in a V-shaped canyon
- Acceptable abutment and foundation geology
- Borrow site G to provide granular material for filters and concrete aggregate.



Devil Canyon Hydropower Plan



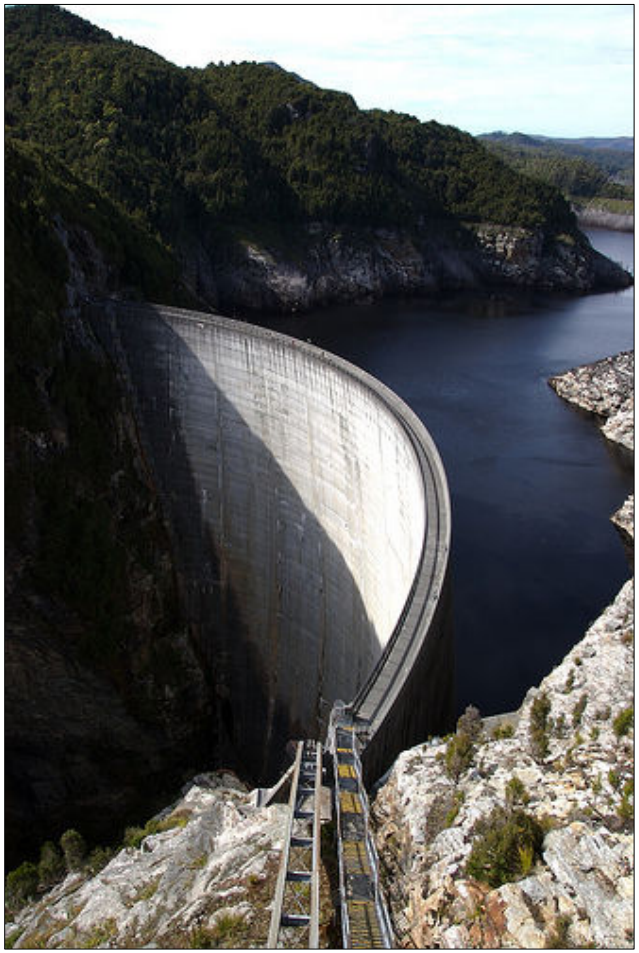
Devil Canyon General Arrangement



Arch Concrete Dams

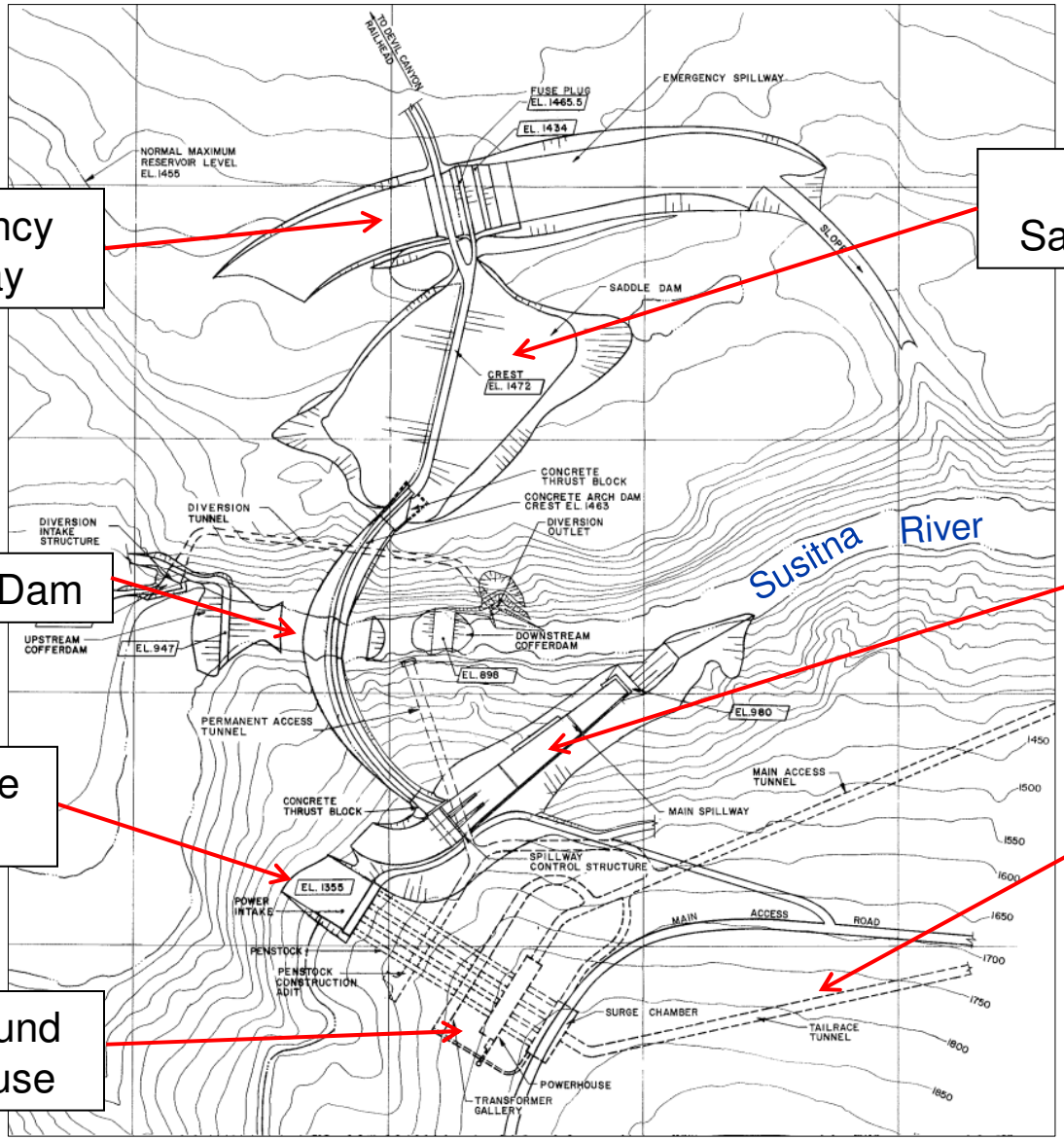
- Reduced material volume to construct
- Loads transferred to abutments
- Structurally efficient, visually appealing structures

Mauvoisin Dam, Switzerland



Gordon Dam, Australia

Project Layout: Devil Canyon



Emergency Spillway

Rockfill Saddle Dam

Thin Arch Dam

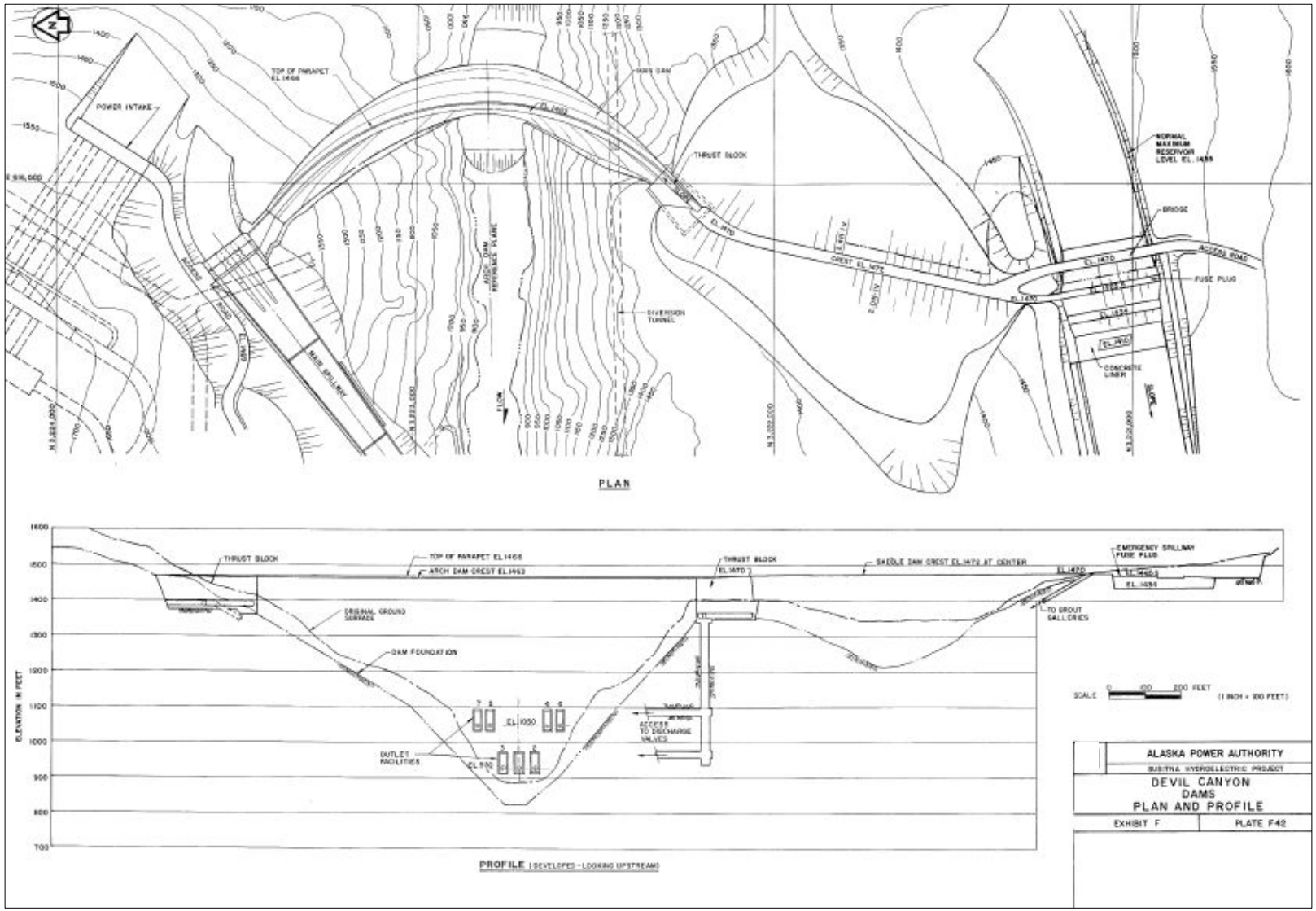
Main Spillway

Powerhouse Intake

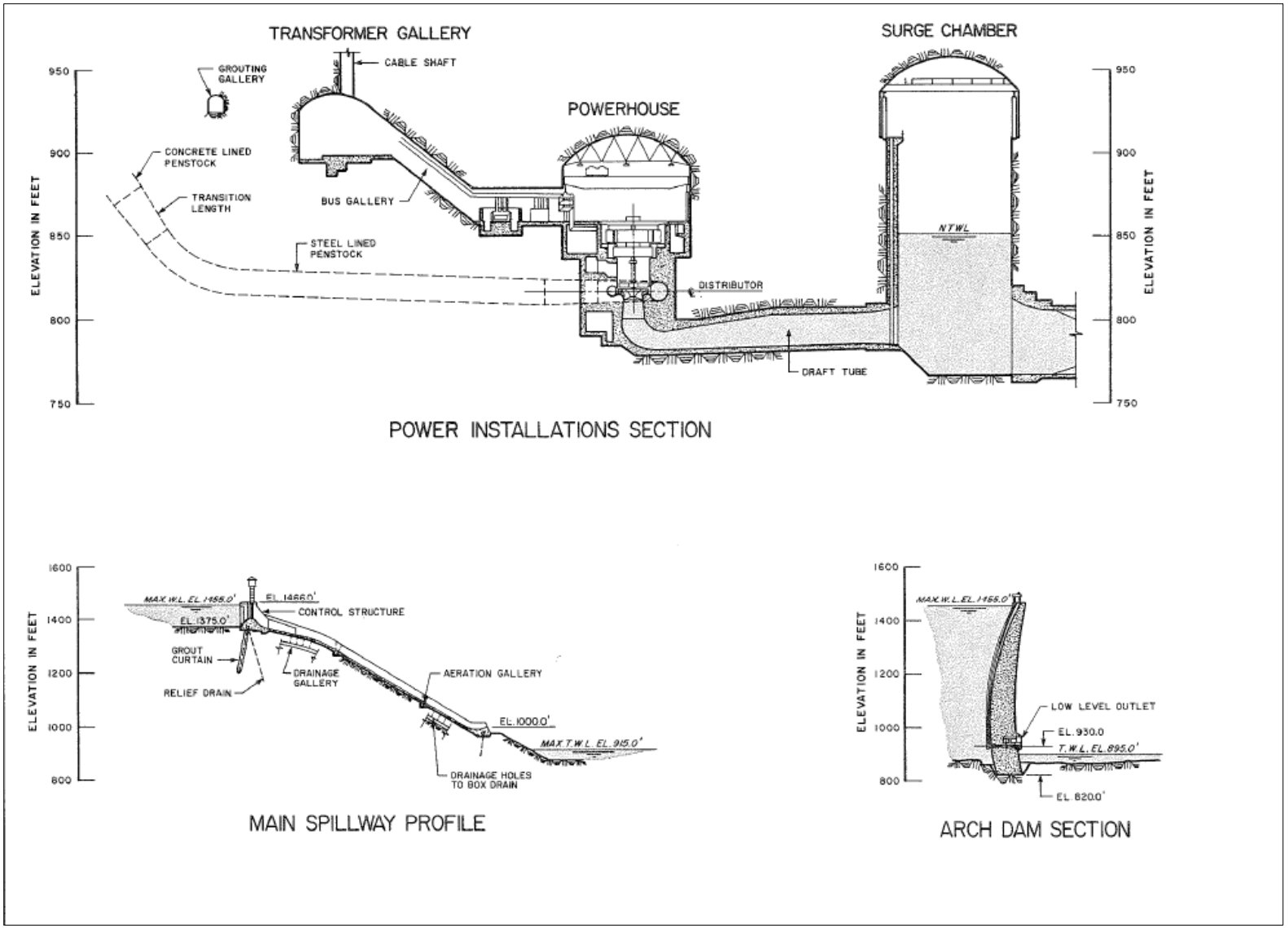
Tailrace Tunnel

Underground Powerhouse

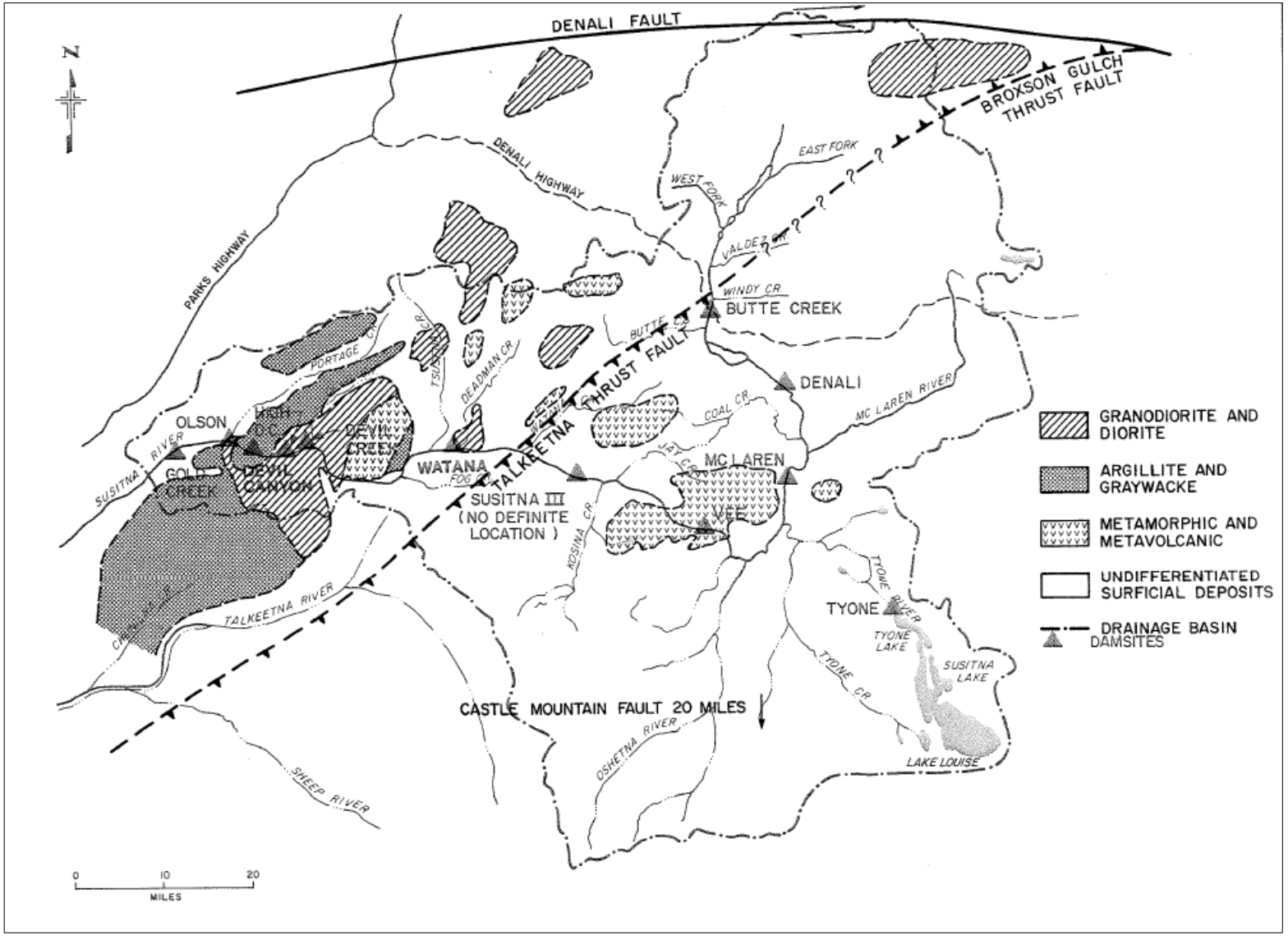
Devil Canyon Dams Plan and Profile



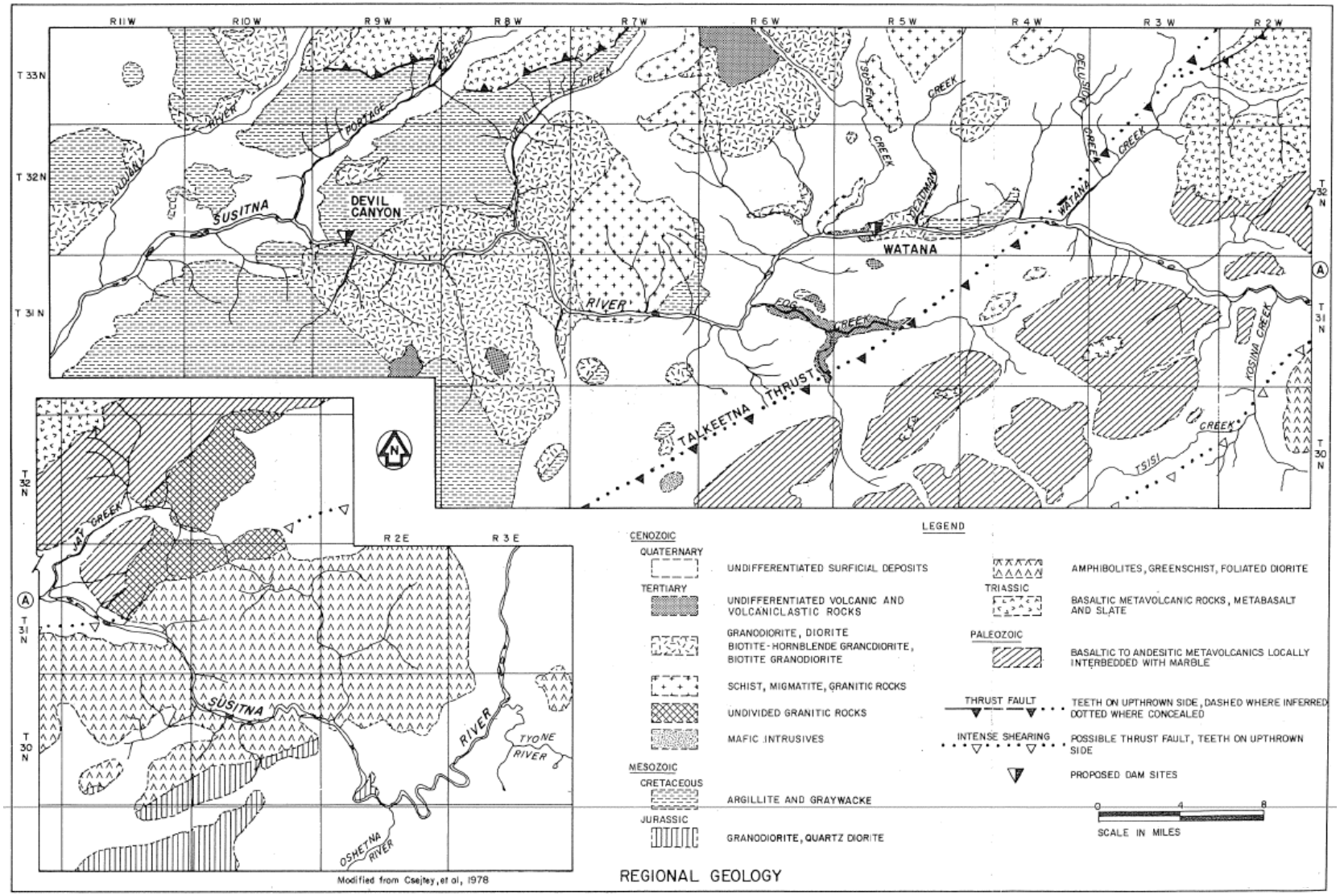
Devil Canyon Details



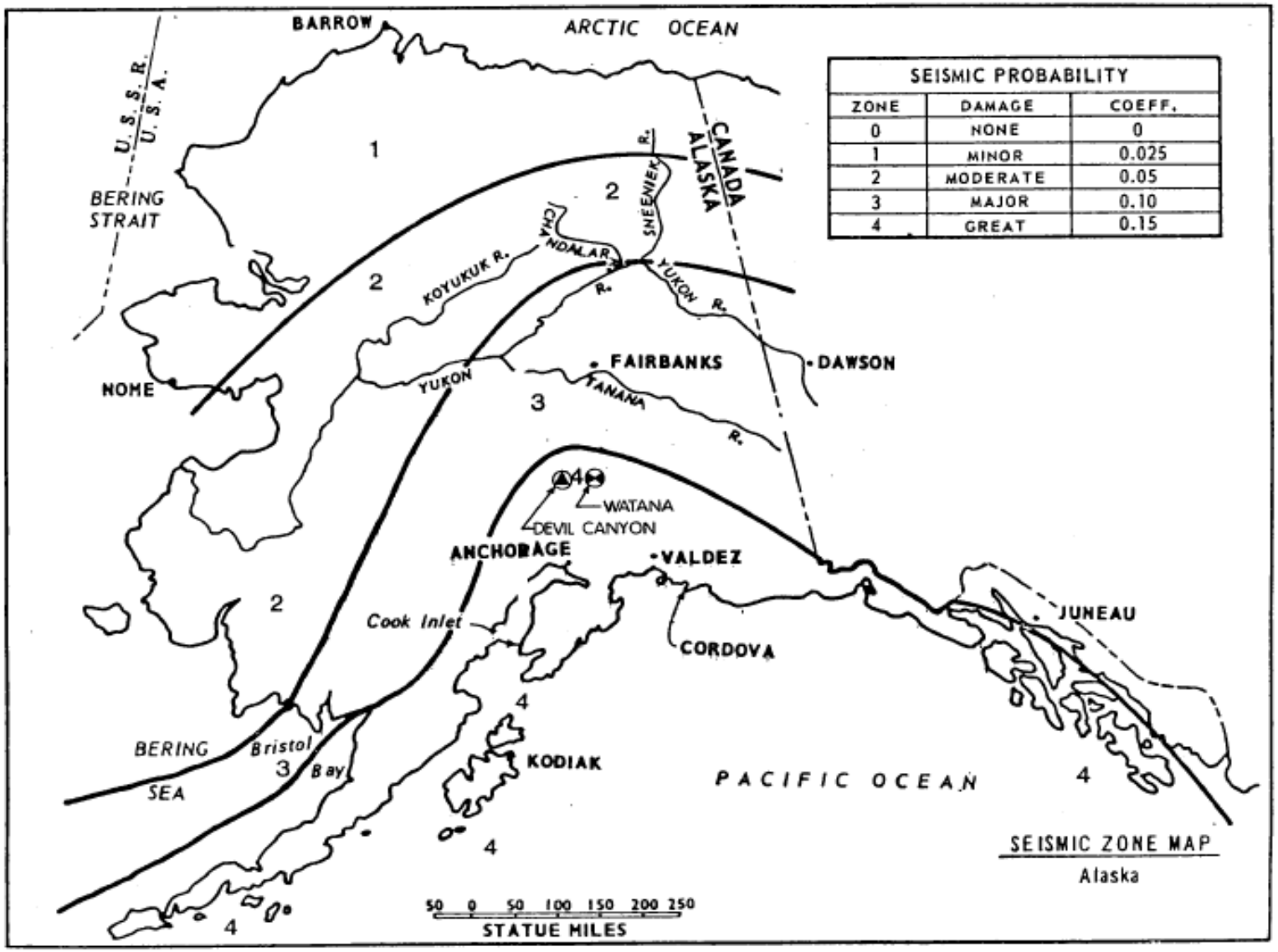
Upper Susitna Basin Geology



Regional Geology



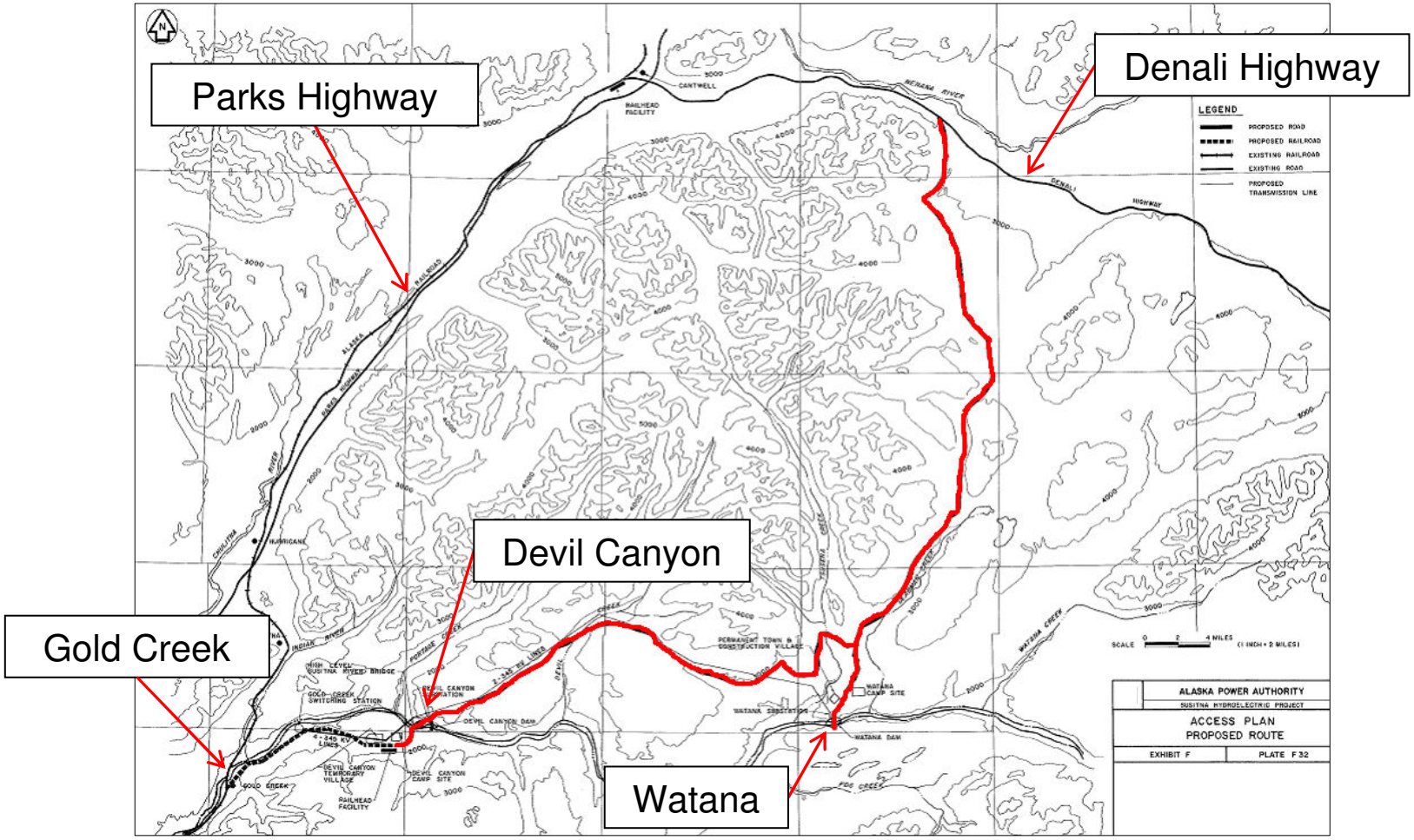
Seismicity



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

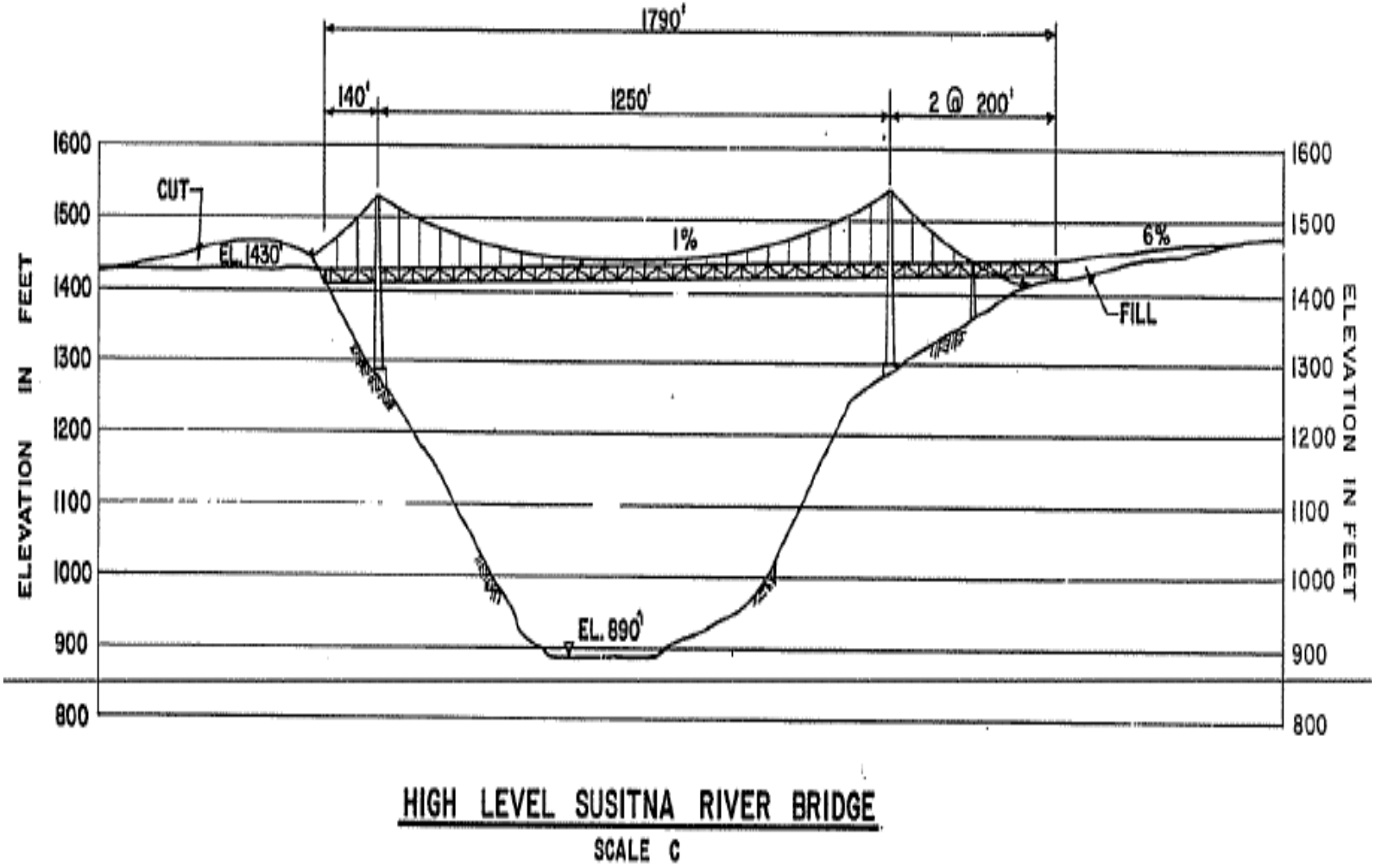
Roads

- 21 miles of road improvements along Denali Highway
- 81 miles of new permanent roadway were planned
- Additional temporary local area construction access roads necessary



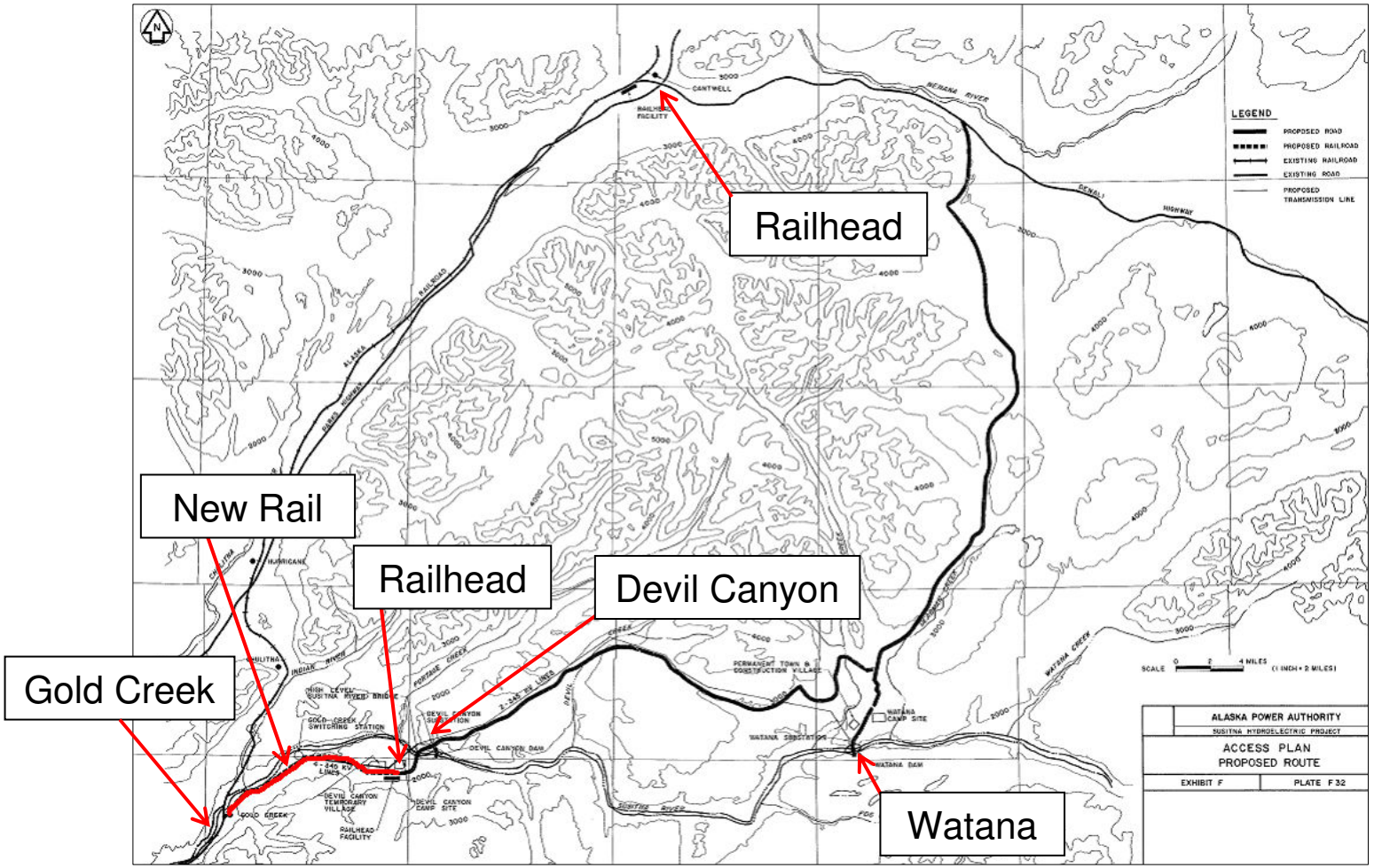
Susitna River Bridge

Substantial, new long-span suspension bridge required for project



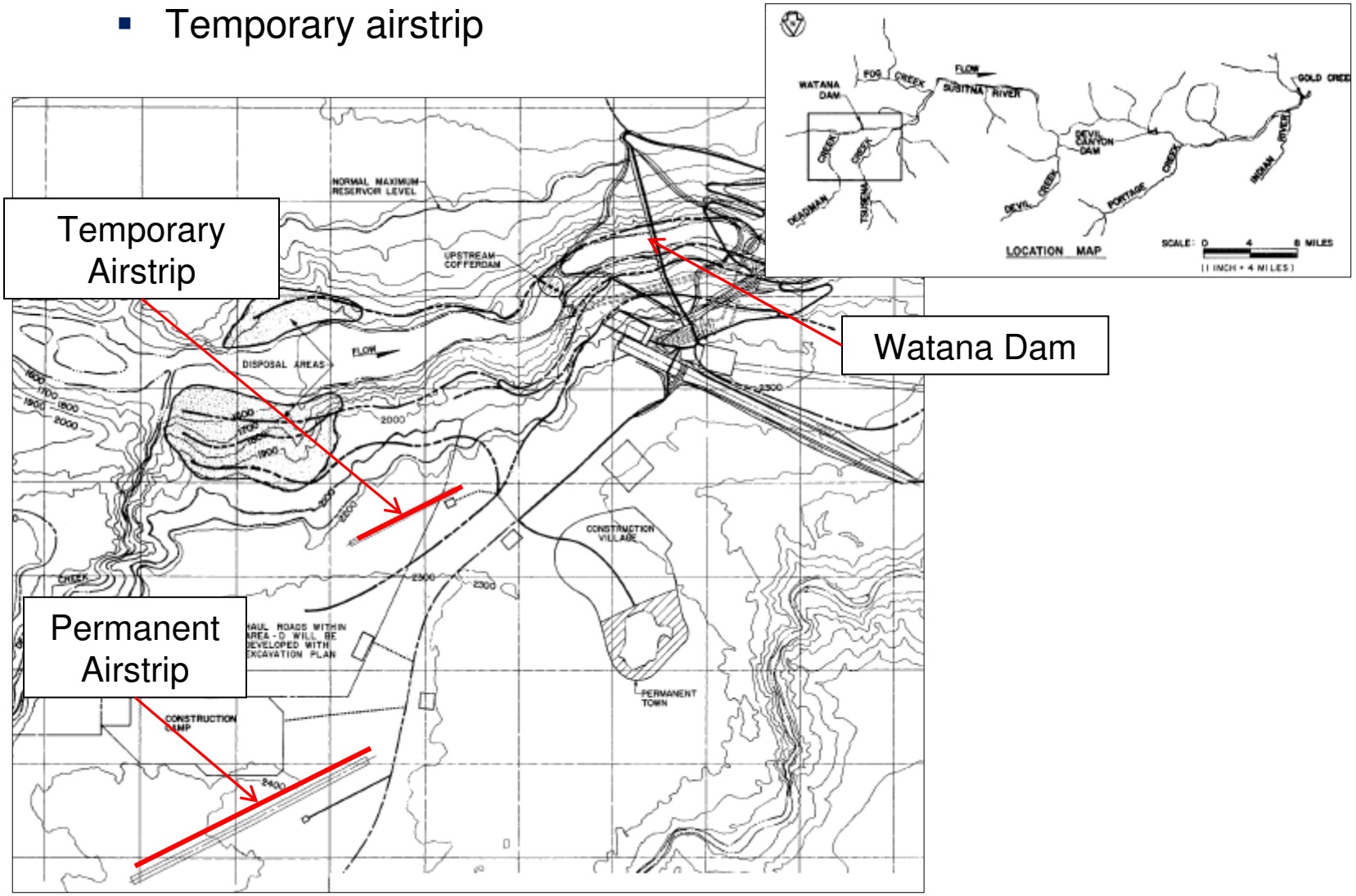
Rail

- 12-mile spur from Gold Creek to Devil Canyon
- Railhead facilities at Cantwell and Devil Canyon

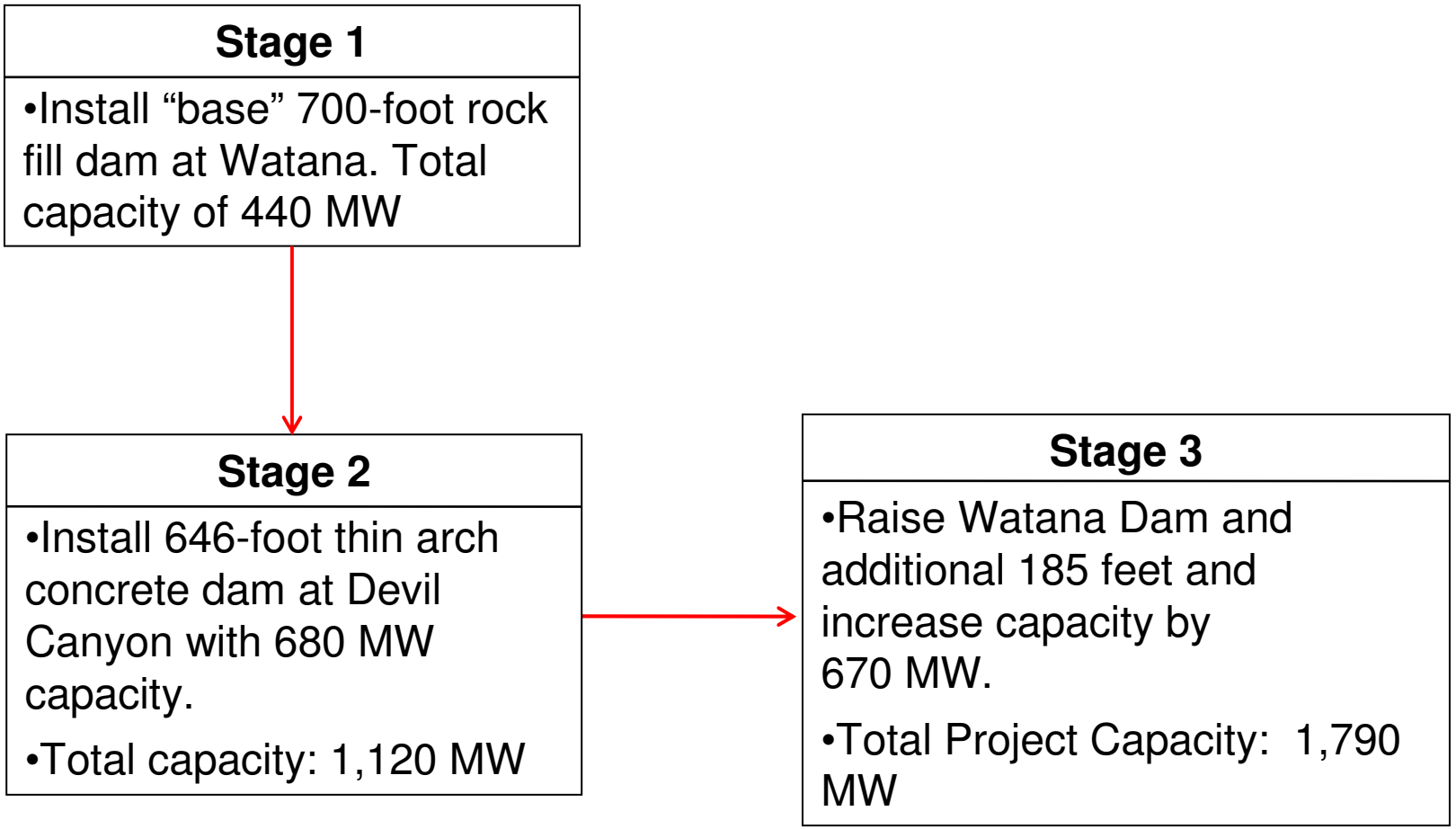


Airports

- Permanent airstrip
- Temporary airstrip



Staged Development Plan



Options Considered for Staged Development

- Option 1 – Full-scale Watana only
- Option 2 – Full-scale Watana and full Devil Canyon in stages
  - Dam, powerhouse and other features built to full-scale plans
  - Stage 1 - Install two 150-MW units, penstocks and tailraces
    Install foundations for two future 150-MW units
  - Stage 2 - Install two 150-MW units, penstocks and tailraces
- Option 3 – Watana Stage 1 only
  - Initial dam 200 feet lower than final stage
  - Powerhouse excavated to final size
  - Three150- MW units installed initially with a foundation for one more unit
- Option 4 – Full-scale Devil Canyon only

Conclusions

- Remote location and large dam configurations require extensive civil works
- Large scale project, but all of these elements have been successfully done elsewhere
- Project is suited to staged construction
- Site access is particularly challenging
  - 81 miles of new road
  - 12 miles of new railroad
  - 1,200’ span suspension bridge
- Technical challenges are all manageable
- Logistics and local material suitability and availability are important constructability factors