

Agency: Commerce, Community and Economic Development**Grant Recipient: The Alaska Energy Authority****Project Title:****Project Type:** New Construction and Land Acquisition

AEA - Battle Creek Diversion

State Funding Requested: \$20,000,000**House District: 35 / R**

Future Funding May Be Requested

Brief Project Description:

Diversion of the flow of Battle Creek into the existing reservoir of the state-owned Bradley Lake hydroelectric project will allow the project to generate more power.

Funding Plan:

Total Project Cost:	\$31,500,000
Funding Already Secured:	(\$500,000)
FY2012 State Funding Request:	<u>(\$20,000,000)</u>
Project Deficit:	\$11,000,000

Funding Details:

The Bradley Lake hydroelectric project came on line in 1991. It was funded by a combination of state equity and state-issued bonds. The Railbelt utilities pay the annual debt service on the bonds in proportion to the amount of power they take from the project.

Detailed Project Description and Justification:

Diverting the Battle Creek watershed into Bradley Lake could add up to 36,000 MWh per year of energy to the project's output. This amount of power is worth about \$1,444,000 per year to the Railbelt electric utilities at today's prices. All six utilities in the Railbelt take power from Bradley Lake, maintain the hydroelectric plant and pay the debt service on outstanding bonds.

Project Timeline:

This project will probably take 5 years, with anticipated annual expenditures of total costs anticipated to be 1.5%, 8.5%, 40%, 40% and 10%.

Entity Responsible for the Ongoing Operation and Maintenance of this Project:

The Railbelt utilities that buy the output of the Bradley Lake hydro project

Grant Recipient Contact Information:

Name: Rebecca Logan
 Title: ARCTEC board member
 Address: 646 West 4th Ave., Suite 200
 Anchorage, Alaska 99501
 Phone Number: (907)563-2226
 Email: rlogan@alaskaalliance.com

Has this project been through a public review process at the local level and is it a community priority? Yes No

March 8, 2011

R&M No. 1158.19-09

Mr. Bryan Carey, P.E., Project Manager
Alaska Energy Authority
813 West Northern Lights Boulevard
Anchorage, Alaska 99503

RE: Bradley Lake Hydroelectric Project
Upper Battle Creek Drainage Basin
Potential Diversions Additional Drainage Area Studies

Dear Mr. Carey:

R&M performed a preliminary feasibility study for capturing Upper Battle Creek drainage basin runoff from the watershed areas in the vicinity of the existing Upper Battle Creek Diversion that are not presently captured because of terrain features. The potential for redirecting the runoff from those drainage areas was considered in 1990 by Stone and Webster (S&W) but the potential diversion was not constructed.

The potential additional watershed was originally identified on USGS maps by S&W. For the present study, a new topographic map was developed from satellite imagery by our sub-consultant eTerra. The digital information from the new mapping allowed the use of the GeoMapper program to identify potential watershed/sub-watershed areas in the area of interest and diversion locations for the contiguous watershed areas that can potentially be developed. The potential additional watersheds that can potentially be diverted to Bradley Lake are shown on the attached Upper Battle Creek Watershed map.

These three watershed areas are defined by terrain features and potential diversions as follows:

- Watershed #1 is the area captured by construction of the primary diversion dam (Dam #1). This watershed is approximately 7.59 square miles and includes approximately 3.10 square miles of glacier.
- Watershed #2 is the area captured by construction of an additional diversion dam (Dam #2). This watershed is approximately 0.68 square miles and contains no glaciers.
- Watershed #3 is the area captured by construction of an open channel ditch conveying the water from Watersheds #2 and #3 to Bradley Lake. This watershed is approximately 0.73 square miles including steep terrain slope potentially shedding water to the collection-

conveyance ditch but ultimately depends on the exact location of the collection-conveyance ditch. If tunnel conveyance is used from Dam #2 to Dam #1, the area of watershed captured will be about 0.5 square miles.

Potential flows that may be diverted from the Upper Battle Creek Watershed and the estimated annual maximum revenue based on \$0.065 per kWh are as follows:

Upper Battle Creek Watershed Area	Energy, kWh Per Annum	Revenue, Dollars Per Annum
Watershed Area #1	54,327,821	\$ 3,531,308
Watershed Area #2	2,585,229	\$ 168,040
Watershed Area #3	2,775,319	\$ 180,396
Total Watershed	59,688,370	\$ 3,879,744

Conceptual Development

The proposed Upper Battle Creek (UBC) diversion would divert glacial melt waters from the UBC watershed(s) to Bradley Lake for use in power generation in the existing Bradley Lake Hydroelectric Project facilities. Upper Battle Creek diversion(s) would generally involve the construction of concrete diversion dams in the range of 20 to 30 ft high and 55 to 75 ft long. Open channel ditch conveyances would be trapezoidal in cross-section. Access roads to the diversion site(s) and along the open channel conveyance will be nominally 12 to 18 feet wide with grades less than 10%. Tunnels would be 10-ft by 10-ft horseshoe cross-section and be unlined except in weak rock areas.

Drawings showing possible diversion plans and conveyance profiles are attached for the alternative approaches noted in this letter.

Capital Costs of Diversions and Conveyance

The capital cost includes Engineering and Construction Costs estimated to develop the structures and water conveyance facilities necessary to divert water from the Upper Battle Creek drainage to Bradley Lake for the three options considered in this study is as follows:

ESTIMATED ROM COSTS TO DEVELOP AND DIVERT UPPER BATTLE CREEK WATERSHEDS						
AREAS DEVELOPED AND DIVERTED	DIVERSION & CONVEYANCE	Base Construction Cost	Ancillary Costs	SUBTOTAL	Contingency At 30%	TOTAL
Divert Areas #1, #2 and #3 = 8.97 SQ-MI	2 Dams and Ditch	\$ 19,130,000	\$ 5,160,000	\$ 24,290,000	\$ 7,287,000	\$ 31,577,000
Divert Areas #1, #2 and #3A = 8.77 SQ-MI	2 Dams and Tunnel	\$ 43,110,000	\$ 8,310,000	\$ 51,420,000	\$ 15,426,000	\$ 66,846,000
Divert Area #1, = 7.59 SQ-MI	1 Dam and Tunnel	\$ 37,440,000	\$ 7,570,000	\$ 45,010,000	\$ 13,503,000	\$ 58,513,000

Recommendations

Based on our prefeasibility study findings we recommend a full Feasibility Study with preliminary design and geotechnical/geologic field data gathering be performed to more specifically assess the potential diversion(s) for construction.

Also, during the upcoming summer season, a number of photo-identifiable points on the ground need to have elevation and coordinates established to allow verifying the control used in the southerly portion of the topographic information generated from satellite data; this is due to the lack of known survey control points from the Bradley Lake original survey net that could be identified through satellite data only. Ground locations using high order GPS by a surveyor would provide the necessary information to verify the topographic electronic data base and developed image(s).

The development of the proposed diversion(s) is a major undertaking and a thorough feasibility study should be conducted to confirm the initial proposed conceptual development for the diversion.

This development of an Upper Battle Creek diversion will require a FERC License Amendment and associated supplementary environmental impact statement. The necessary up-front studies including the previously mentioned detailed feasibility report, environmental reconnaissance studies, in-stream flow studies, topographic and ground surveys and geotechnical reconnaissance studies should be performed or at least started within this coming summer season.

Please contact me at your convenience with any questions on the above. Our completed detailed report is being finalized and will be forwarded shortly

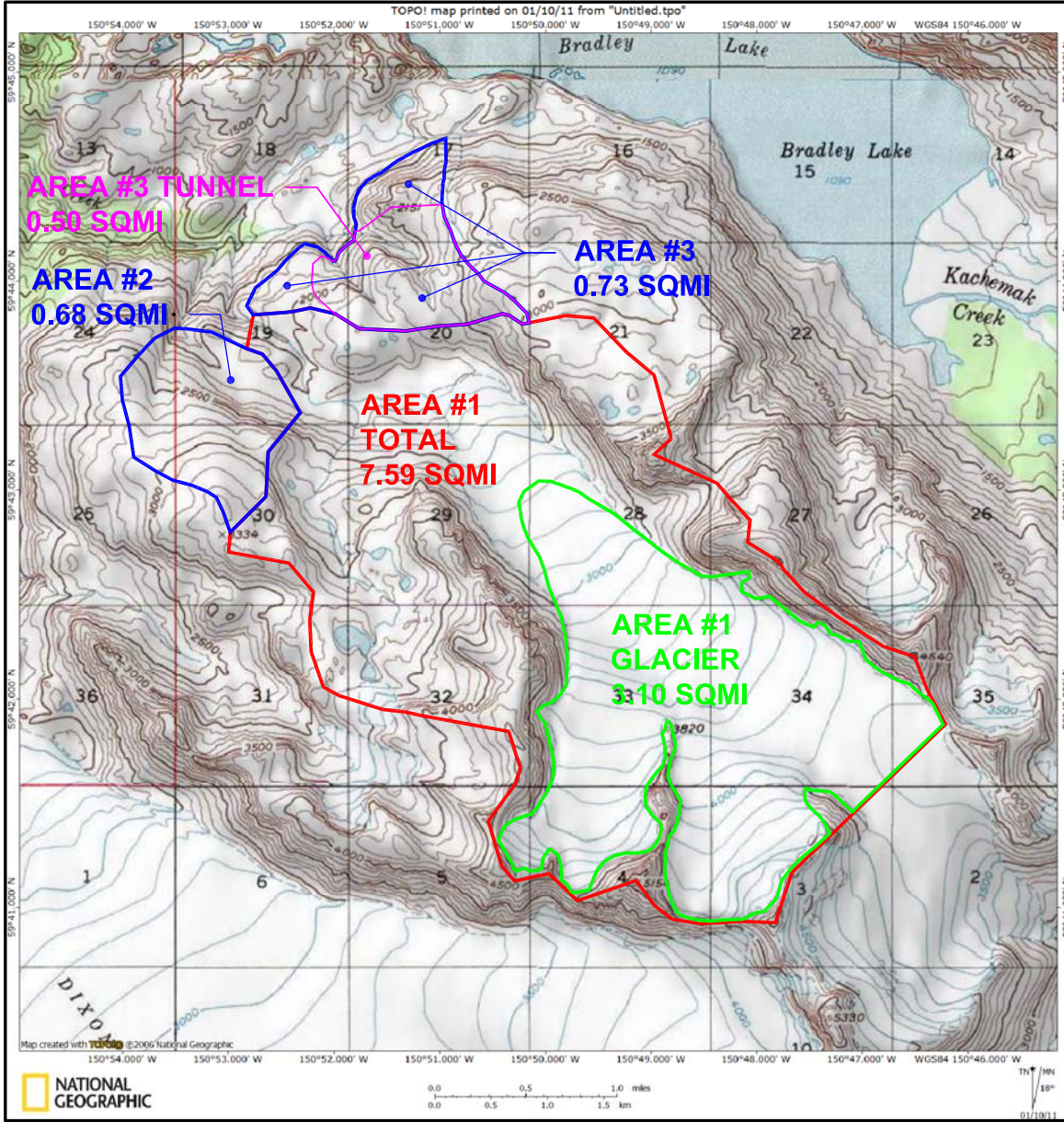
Sincerely,

R&M CONSULTANTS, INC.



John Magee, P.E.
Project Manager

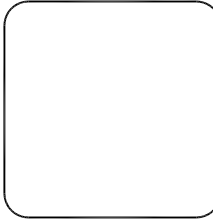
Attachments



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 ENGINEERING SURVEYING EARTH SCIENCES MATERIAL TESTING

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 Anchorage, Alaska 99507
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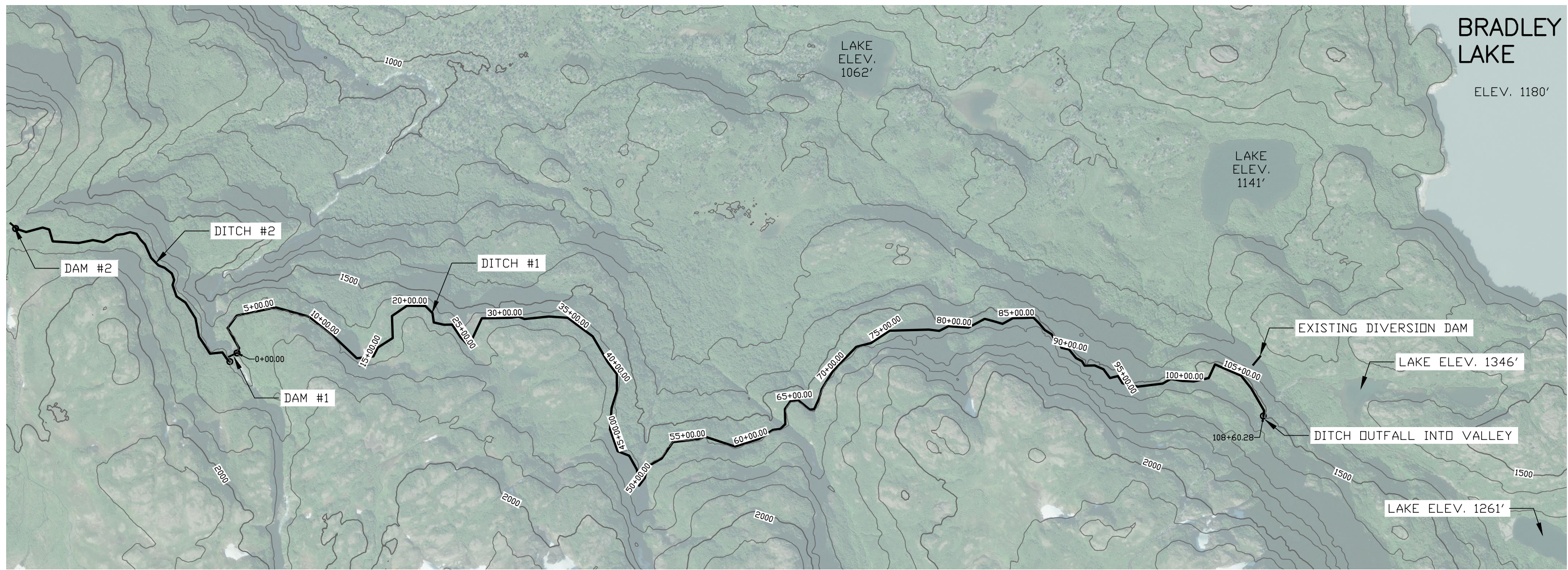


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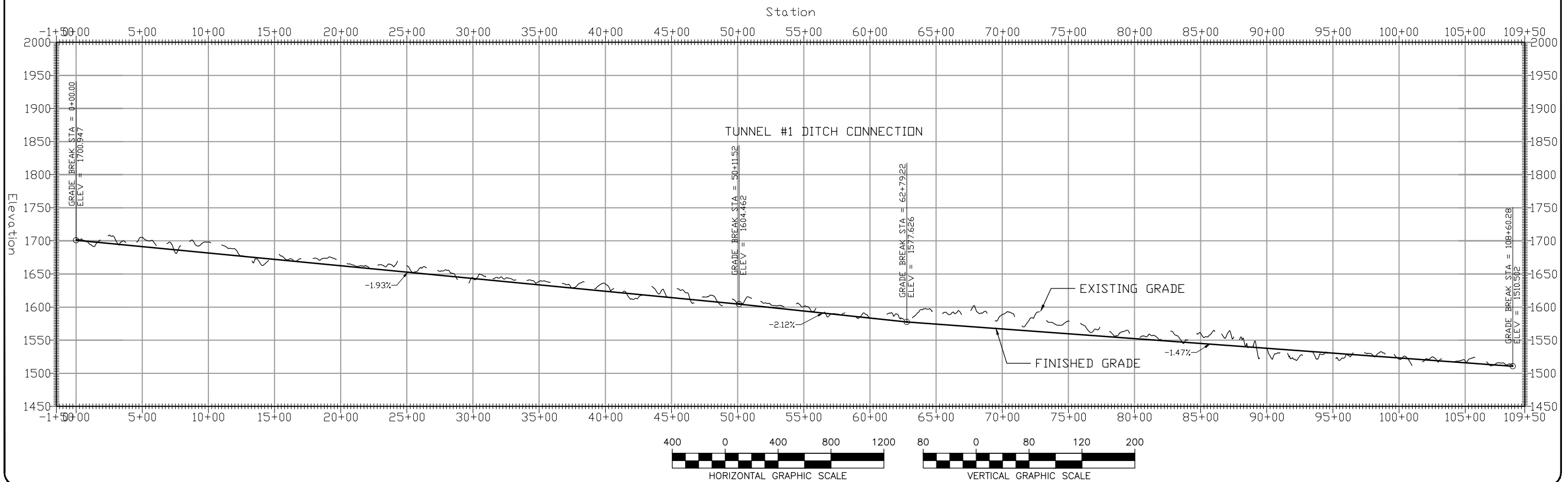
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 BRADLEY LAKE HYDROELECTRIC PROJECT
 BATTLE CREEK DIVERSION
 PRE-FEASIBILITY STUDY

**UPPER BATTLE CREEK
 POTENTIAL WATERSHED
 ADDITION**

DATE: 2/25/2011
 R&M NO. 1158.19
 SCALE: AS NOTED



Battle Creek Diversion Ditch PROFILE



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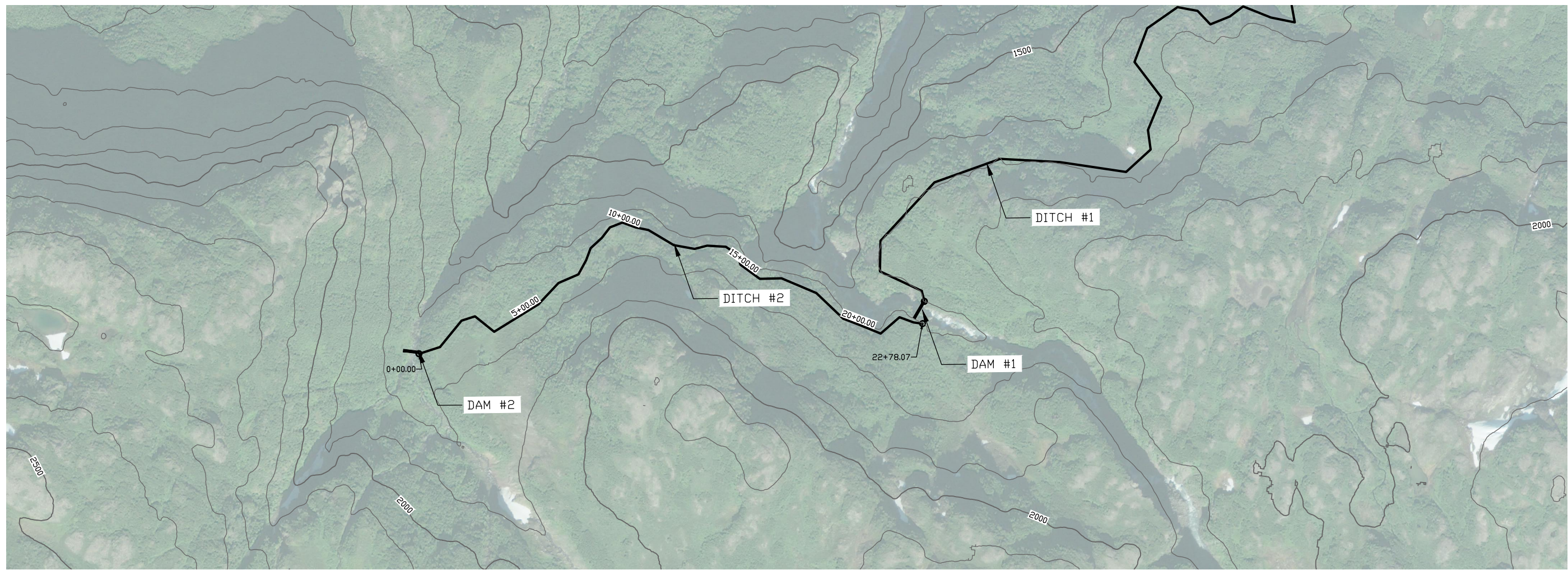
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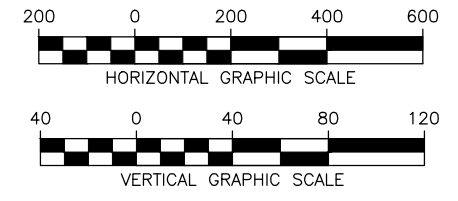
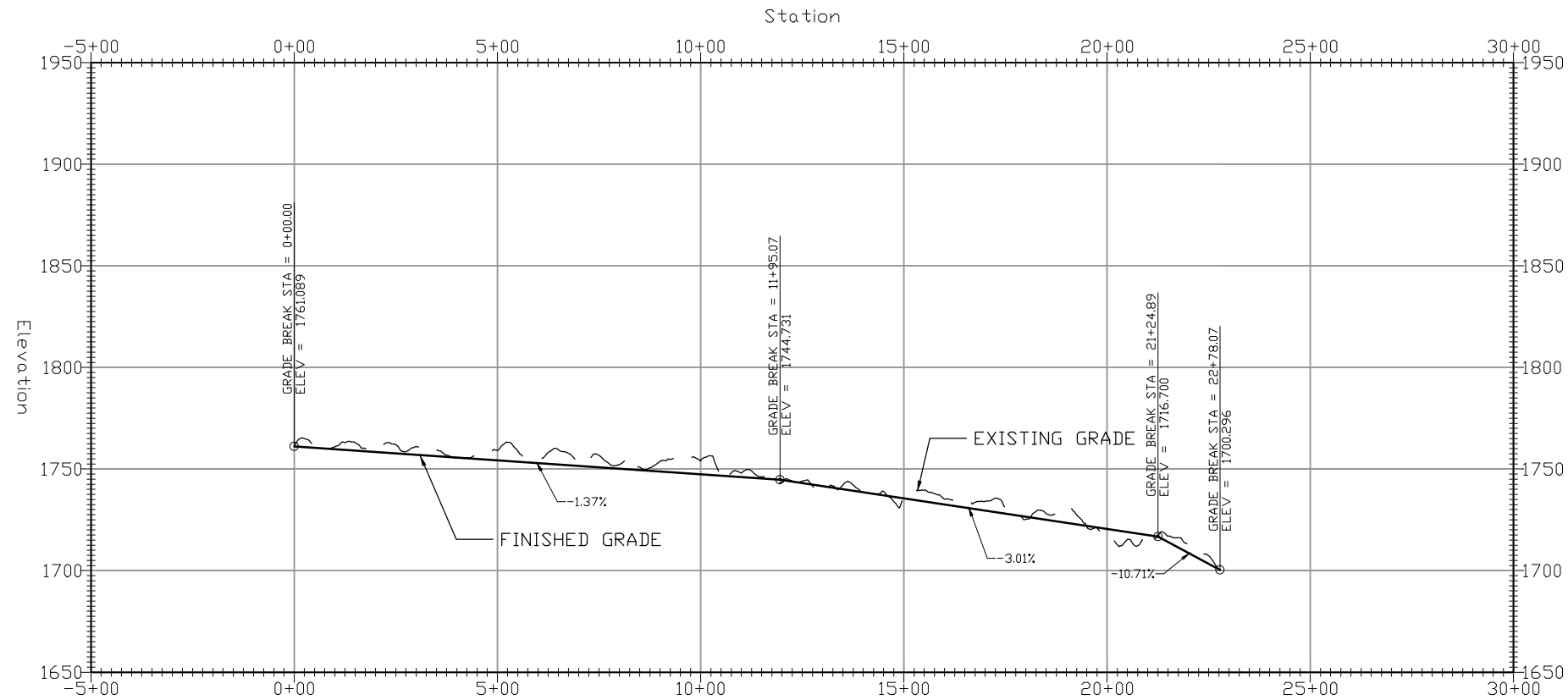
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 PRE-FEASIBILITY STUDY

**DITCH CONVEYANCE OPTION
 DITCH 1
 PLAN & PROFILE**

DATE: 2/25/2011
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 SCALE: AS NOTED



Area 2 Diversion Ditch PROFILE



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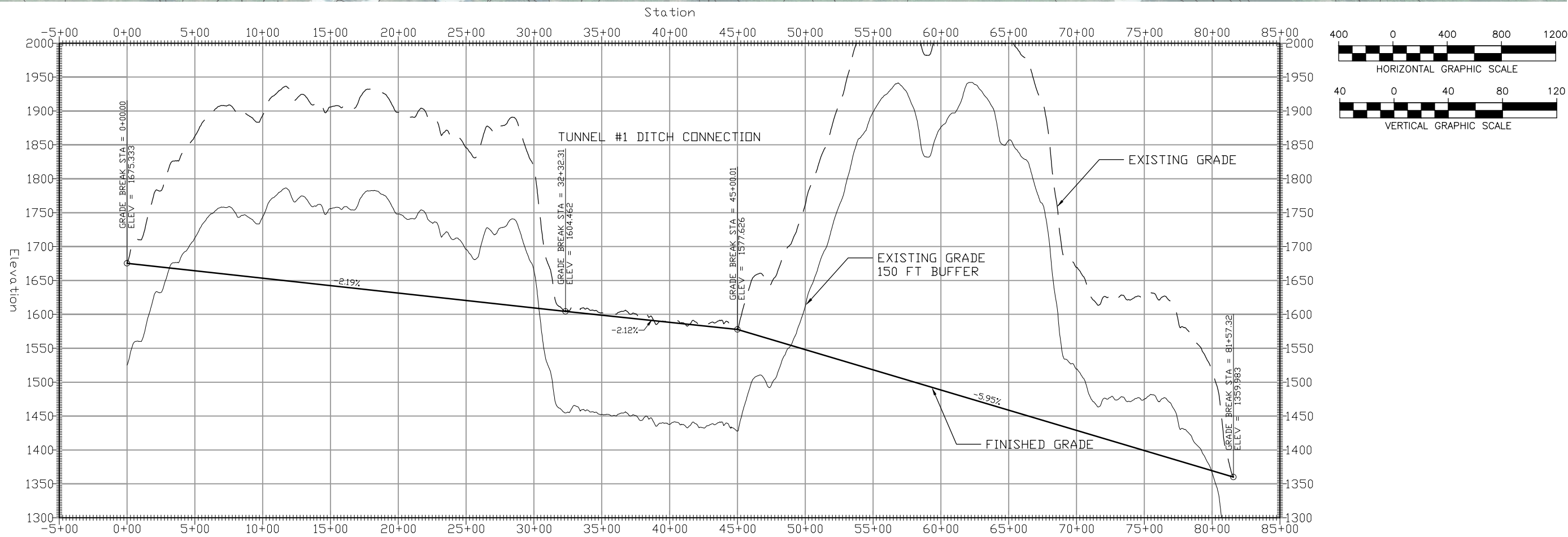
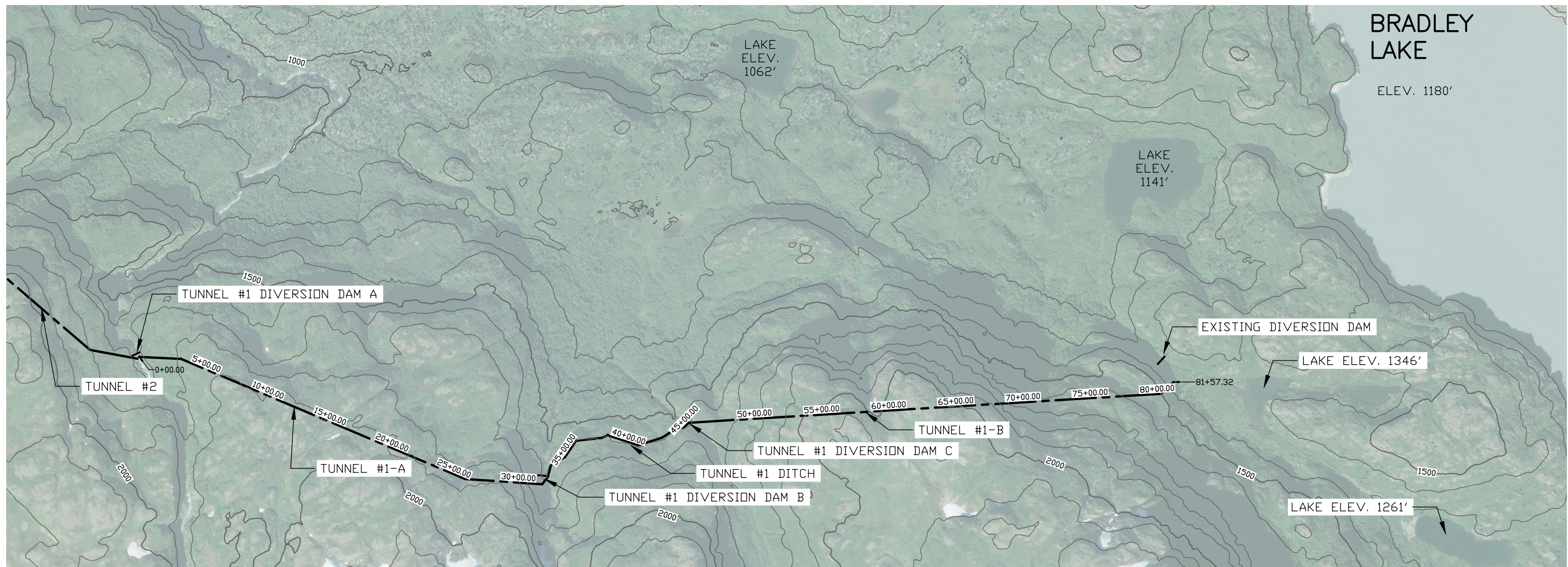
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**DITCH CONVEYANCE OPTION
 DITCH 2
 PLAN & PROFILE**

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 SCALE: AS NOTED

APPENDIX G

Tunnel Conveyance Concept Drawings



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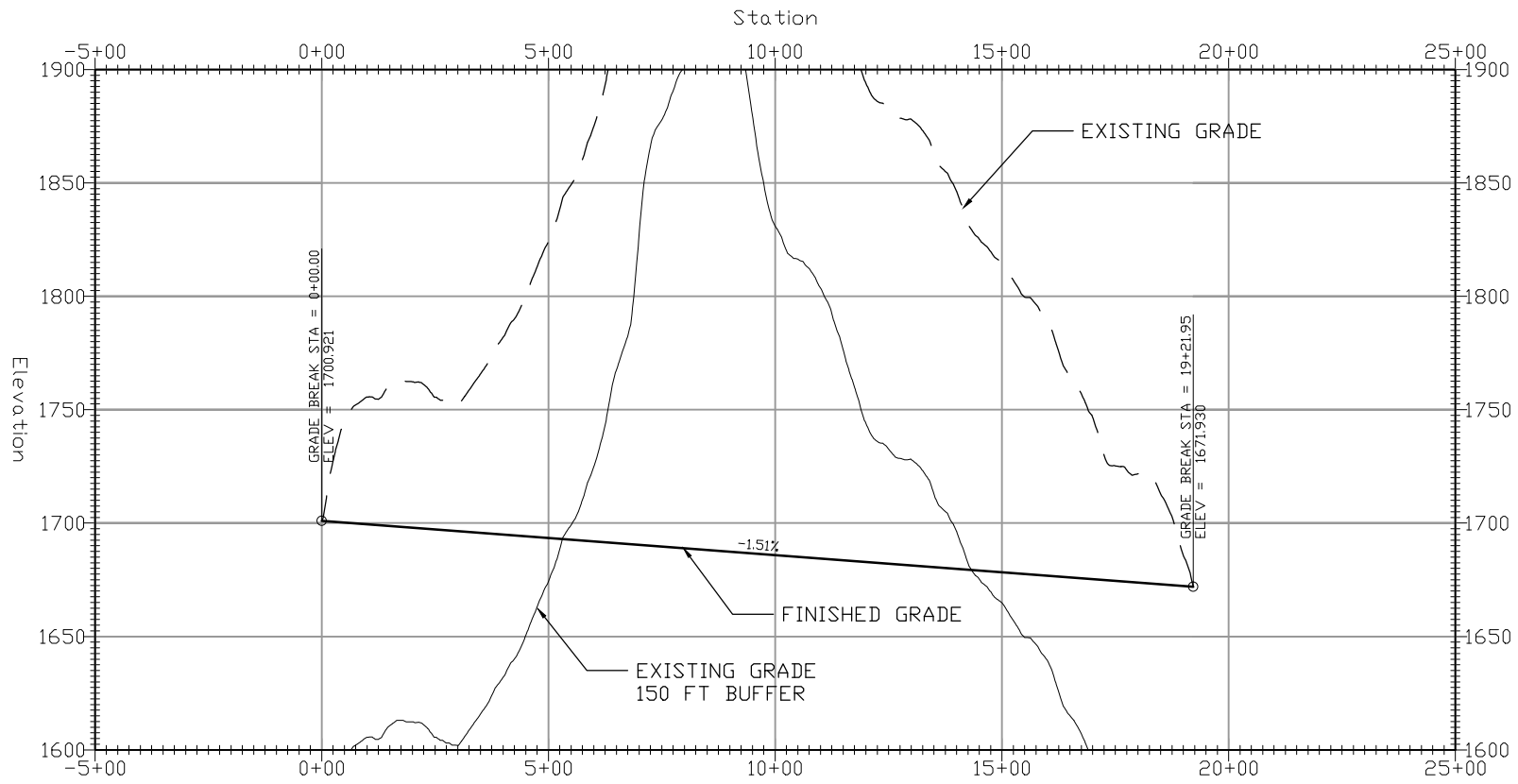
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**TUNNEL CONVEYANCE OPTION
 TUNNEL 1
 PLAN & PROFILE**

DATE: 2/25/2011
 R&M NO. 1158.19
 SCALE: AS NOTED



Tunnel 2 PROFILE



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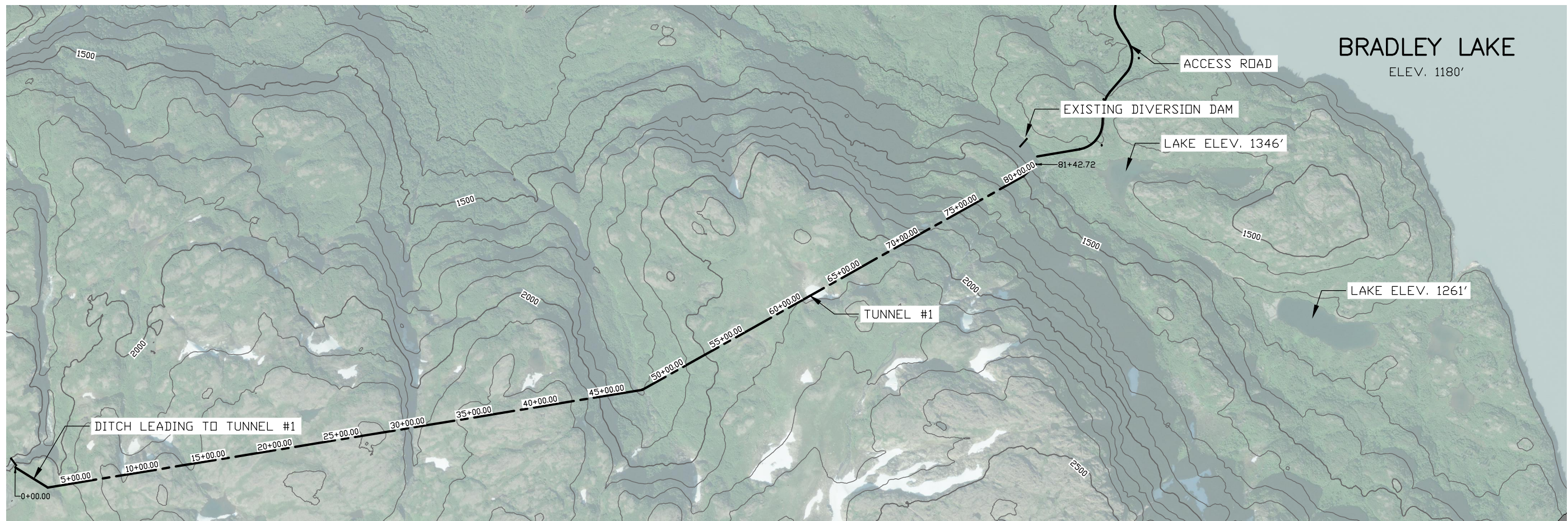
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**TUNNEL CONVEYANCE OPTION
 TUNNEL 2
 PLAN & PROFILE**

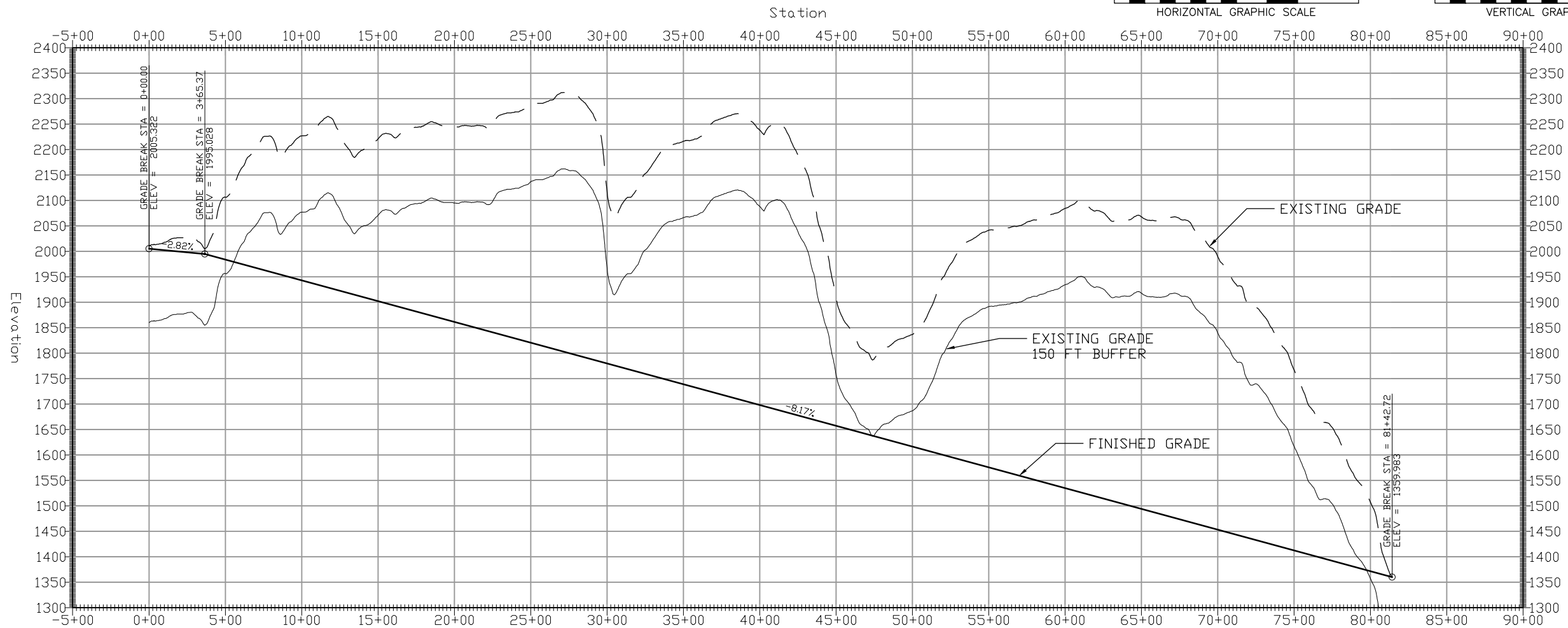
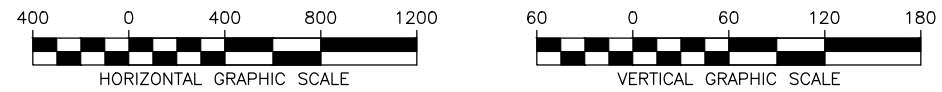
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APPENDIX H

Alternative Tunnel Conveyance Concept Drawings



Tunnel 1 PROFILE



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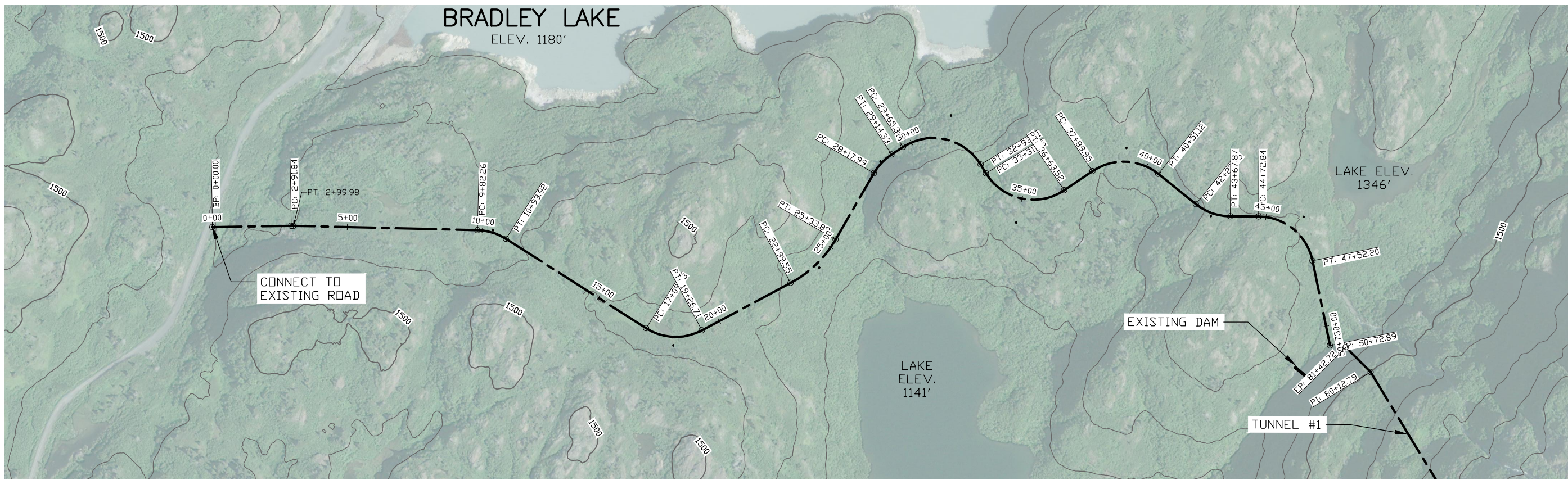
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**ALTERNATIVE TUNNEL
 CONVEYANCE OPTION
 TUNNEL 1 PLAN & PROFILE**

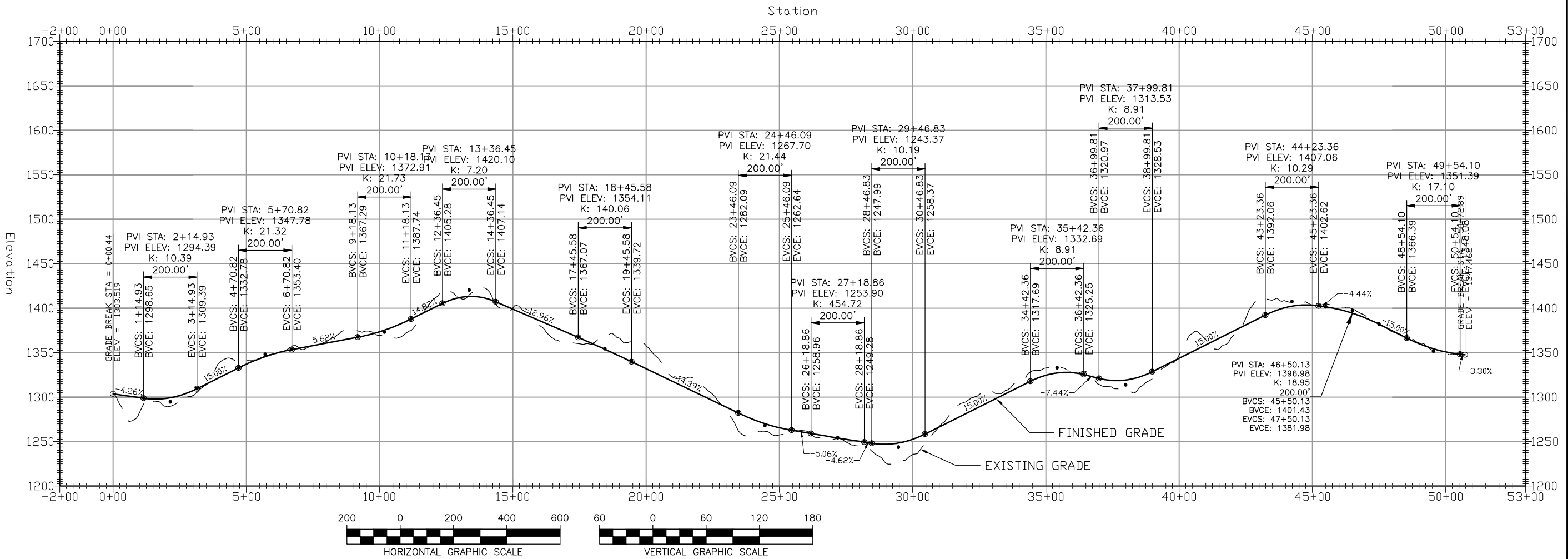
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APPENDIX I

Access Road Concept Drawings



ACCESS ROAD PROFILE



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**ACCESS ROAD
 PLAN & PROFILE**

DATE: 2/25/2011
 R&M NO. 1158.19
 SCALE: AS NOTED