

WATER POWER ACT LICENCES

MCARTHUR FALLS GENERATING STATION SHORT TERM LICENCE EXTENSION APPLICATION

SUPPORTING DOCUMENTATION

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HYDRAULIC OPERATIONS DEPARTMENT
POWER SALES & OPERATIONS DIVISION
POWER SUPPLY

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APPLICATION

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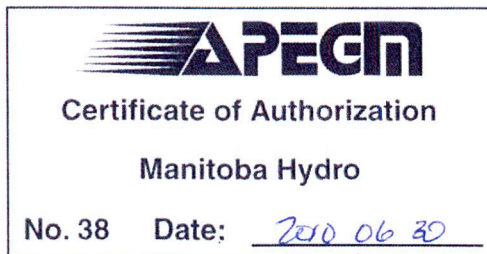
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1.0 INTRODUCTION

This report is provided at the request of Manitoba Water Stewardship to provide additional information in support of a short-term extension licence application. Manitoba Hydro requested this extension licence on February 04, 2010 in accordance with Section 92 of The Water Power Regulation, Manitoba Regulation 25/88R of The Water Power Act.

Manitoba Hydro operates the McArthur Falls Generating Station in accordance with the Final Licence for the Development of Water Power at the McArthur Falls Site on the Winnipeg River. This licence was issued in accordance with the provisions of The Water Power Act on November 30, 1965. The licence was issued for a term of 50 years to be computed from January 1, 1955.

Manitoba Hydro submitted the application to renew the Final Licence on February 26, 1999. With recent staffing improvements by both Manitoba Hydro and Manitoba Water Stewardship, there is a renewed focus on issuing a renewal of the Final Licence. Manitoba Hydro and Manitoba Water Stewardship are currently working through a process which will inform the Provincial Department's decision making process on issuing a renewal of the Final Licence.

2.0 PROJECT COMPONENTS

The McArthur Falls Generating Station is located approximately 120 km (75 miles) northeast of the City of Winnipeg and 42 km (26 miles) upstream of Lake Winnipeg, as shown in Figure 1. Figure 2 is an overall site map that shows the layout of the major project components. Photograph 1 shows the McArthur Falls Generating Station powerhouse and sluiceway type spillway.

The McArthur Falls Generating Station consists of a powerhouse, spillway and dykes and has a name plate capacity of 59.7 MW (80,000 hp). The station, constructed between 1952 and 1955, is the newest and smallest of the six generating stations operating on the Winnipeg River.

The station components include an eight unit powerhouse with east gravity structure, an eight bay gated spillway with east and west gravity structures and a total of fifteen dykes. The dykes are divided by the spillway and powerhouse into the east dykes with a total length of 0.37 km (0.23 miles), the center dykes with a total length of 0.58 km (0.36 miles) and the west dykes with a total length of 8.8 km (5.5 miles). The dam and the dykes impound Lac Du Bonnet. Figures 3 to 9 show the general arrangements of concrete and earth structures. The structures were aligned to take advantage of the natural rock islands in the river channel. Table 1 summarizes the major characteristics of the station.

Table 1: McArthur Falls G.S. Major Characteristics

Construction Period	1952 to 1955
Capability	59.7 MW (80,000 hp)
Average Annual Generation	380 million kW-h
Waterfall Drop (head)	7.0 m (23.0 ft)
Maximum Licence Forebay Elevation	254.81 m (836.0 ft)
Normal Operating Forebay Elevation (NOFE)	254.76 m (835.8 ft)
Available Freeboard @ NOFE - Conc. Structures	1.86 m (6.1 ft) *without wind or wave effects
Available Freeboard @ NOFE - Earth Structures	1.89 m (6.2 ft) *without wind or wave effects

Table 2 summarizes major characteristics of the McArthur Falls powerhouse, spillway and dykes.

Table 2: McArthur Falls G.S. Component Characteristics

Powerhouse	Number of Units	8
	Length	177.2 m (581.5 ft)
	Deck Elevation	256.62 m (841.9 ft)
	Discharge Capability (at full gate)	962.8 m ³ /s (34,000 ft ³ /s)
	Power Production	
	Unit 1	10,000 horsepower
	Unit 2	10,000 horsepower
	Unit 3	10,000 horsepower
	Unit 4	10,000 horsepower
Unit 5	10,000 horsepower	
Unit 6	10,000 horsepower	
Unit 7	10,000 horsepower	
Unit 8	10,000 horsepower	
East Powerhouse Gravity Dam	Length	37.2 m (122.0 ft)
	Design Crest Elevation	256.62 m (841.9 ft)
Spillway	Number of Bays	8 bays
	Length	125.0 m (410.0 ft)
	Deck Elevation	256.64 m (842.0 ft)
	Discharge Capability (at normal operating forebay elevation)	6,220 m ³ /s (219,660 ft ³ /s)
Gravity Dam (East)	Length	115.8 m (380.0 ft)
	Design Crest Elevation	256.64 m (842.0 ft)
Gravity Dam (West)	Length	97.5 m (320.0 ft)
	Design Crest Elevation	256.64 m (842.0 ft)
Earthfill Dykes	Length 1E	274.0 m (899.0 ft)
	2E	30.0 m (98.4 ft)
	3AE	70.0 m (229.7 ft)
	Center Dyke No. 1 & 2	579.0 m (1899.6 ft)
	1W	533.0 m (1748.7 ft)
	2W	312.0 m (1023.6 ft)
	5W	61.0 m (200.1 ft)

	6W	90.0 m	(295.3 ft)
	7W	79.0 m	(259.2 ft)
	8W	290.0 m	(951.4 ft)
	9W	177.0 m	(580.7 ft)
	10W	472.0 m	(1548.6 ft)
	11W	79.0 m	(259.2 ft)
	17W	6681.0 m	(21,919.3 ft)
	Design Crest Elevation (all)	256.64 m	(842.0 ft)

3.0 WATER POWER LICENSING REQUIREMENTS

3.1 Licence Terms

Condition #4 of the Final Licence stipulates that:

“The Licensee shall not raise the headwater of its development to an elevation higher than 836.0 feet above mean sea level, Canadian Geodetic Datum 1929 Adjustment. A higher elevation may be created only with prior written permission by the Director and in accordance with Section 72 of the Regulations.”

Manitoba Hydro operates the McArthur Falls Generating Station so that the forebay water level does not exceed 836.0 feet.

3.2 Licence Area

The licence area extends from approximately 0.6 km (0.4 miles) downstream of the McArthur Falls Generating Station up to the downstream extent of the Seven Sisters Generating Station licence area (approximately 2.5 km downstream of the station). Included in this area are Lac Du Bonnet and the Lee River upstream to PR 313. During the Final Licence renewal, Manitoba Hydro intends to apply to expand the licence area to include land along the Lee River/Pinawa Channel so that the upstream end of the licence area will terminate at the old Pinawa Generating Station. The licence area is shown in Manitoba Water Stewardship file number 21-4-1050. New severance line drawings that reflect all approved changes to the licence area and also show the proposed expansion will be submitted as part of the Final Licence renewal process.

4.0 MONITORING PROGRAMS

4.1 Water Levels

The forebay water level at McArthur Falls is measured and recorded using a water level gauge located in the powerhouse. The gauge consists of a float with

a steel tape draped over a pulley on a motor which drives an electronic device in the control room. The device accepts the output of the motor, displays the water level elevation directly to the station operators, and outputs a signal to the Remote Terminal Unit (RTU) for transmission to the System Control Centre. System Control Centre staff monitor the water level data and respond to alarms as required. The water level data is also recorded on Daily Hydraulic Reports that are forwarded to the Operating Supervisor. The report is reviewed, signed and sent to the Hydraulic Operations Department. The Hydraulic Operations Department staff enters the data into a hydrometric database that is accessible to interested parties within Manitoba Hydro.

The station operators at McArthur Falls calibrate the forebay gauge manually once a week or as required, such as prior to Uniform Rating of Generating Equipment (URGE) testing. The calibration is performed by comparing the manual reading to the electronic meter in the control room.

Manitoba Hydro prepares an annual report documenting water levels and flows within Water Power Act licence areas. The report contains analysis of water level and flow data related to the licence conditions for the calendar year. Information specific to McArthur Falls includes the analysis of forebay level data, maps, photos, project description, and gauge and data collection description. In addition to the annual report, Manitoba Hydro performs weekly licence compliance checks for all Water Power Act licence conditions. Manitoba Hydro reports licence limit exceedances to Manitoba Water Stewardship upon occurrence.

4.2 Dam Safety

Manitoba Hydro's Dam Safety Program is based on the Canadian Dam Association Guidelines. Both concrete and earth structures continue to be inspected at regular intervals for any anomalies or deficiencies. Routine inspections by Manitoba Hydro staff are performed twice per month for the earth structures (with the exception of Dyke 11W which is inspected once per year as it is considered a freeboard dyke) and bi-monthly for the concrete structures, including the spillway. Additional inspections of all water retaining structures are performed by specialists from Manitoba Hydro's Engineering Services Division annually. SNC Lavalin performed a Dam Safety Review (DSR) inspection of all the primary structures in 2003/04. Manitoba Hydro has completed a significant amount of work addressing the concerns raised in this DSR. As part of the Water Power Act licence renewal process, we will be providing a condition assessment report of the generating station and its associated structures.

4.3 Aquatic Monitoring

Healthy fish populations exist above and below the McArthur Falls Generating Station. The Fisheries Branch of Manitoba Water Stewardship has documented the fish populations in Lac du Bonnet for last 20+ years. The reservoir is a popular recreational fishing location and continues to be the site of popular angling tournaments each year. Similarly, downstream of the station Manitoba Hydro is aware that anglers routinely fish on the Winnipeg River with reasonable success.

System wide monitoring of aquatic ecosystem health including water quality, lower trophic levels and fish sampling is taking place upstream of McArthur Falls Generating Station under the Coordinated Aquatic Monitoring Pilot Program (CAMPP); a program of activities by which the Government of Manitoba and Manitoba Hydro are working together to provide objective information about hydrometric and environmental effects of hydro-electric development. Sampling is currently occurring in Lac du Bonnet. This work is intended to monitor aquatic ecosystem health on the Winnipeg River into the foreseeable future.

5.0 SYSTEM UPGRADES/STUDIES AND AGREEMENTS

5.1 System Upgrades/Studies

Manitoba Hydro completed significant upgrading and remedial work to all eight of the spillway gates during the 1990's. This work included replacing rollers, splashboards, seals and some painting. In 1997, a new downstream monorail crane was installed to facilitate stoplog placement.

Dyke repairs are ongoing and generally include the placement of quarried rock to improve upstream slope protection as well as the placement of granular fill to upgrade the crest and repair areas of settlement. Major repairs to Dyke 17W were completed in 2002 following an extreme wind event. Repairs to the downstream toe of Centre Dyke #2 were completed in 2008.

In 2007, the Structural Section of the Civil Engineering Department evaluated the stability of the spillway and found that the structure does not meet current CDA stability guidelines. It is important to note that the SNC Lavalin 2003/04 dam safety review concluded that even though current guidelines were not met "the structure has not shown signs of structural distress in almost 50 years of service." Subsequent to this evaluation, the recommendation was put forth to install post-tensioned strand anchors. In 2008 an anchor design was completed. Anchoring is scheduled to proceed in 2010.

A stability assessment of the east and west gravity structures and the east powerhouse gravity structure was completed by the Structural Section of the Civil

gravity structures do not meet current CDA stability guidelines. A recommendation has been put forth to install post-tensioned strand anchors into all three gravity structures. The anchors would be appropriately instrumented, such that their long-term effectiveness can be confirmed.

A 2008 report, completed by the Engineering Services Division, on updated freeboard analyses for the Winnipeg River generating stations indicated that freeboard deficiencies exist at McArthur Falls for extreme wind conditions. A further study was completed in 2009 to determine what steps are required to address these freeboard issues. Results will be forthcoming.

5.2 Agreements

Since the 1950's, agreements have been reached with private land interests in which the effects of hydraulic operations on subject lands are addressed.

6.0 CLOSURE STATEMENT

Manitoba Hydro continues to operate the McArthur Falls Generating Station in accordance with the Final Licence for the Development of Water Power at the McArthur Falls Site on the Winnipeg River. Manitoba Hydro operates and maintains the generating station and associated structures based on the Canadian Dam Association Guidelines.

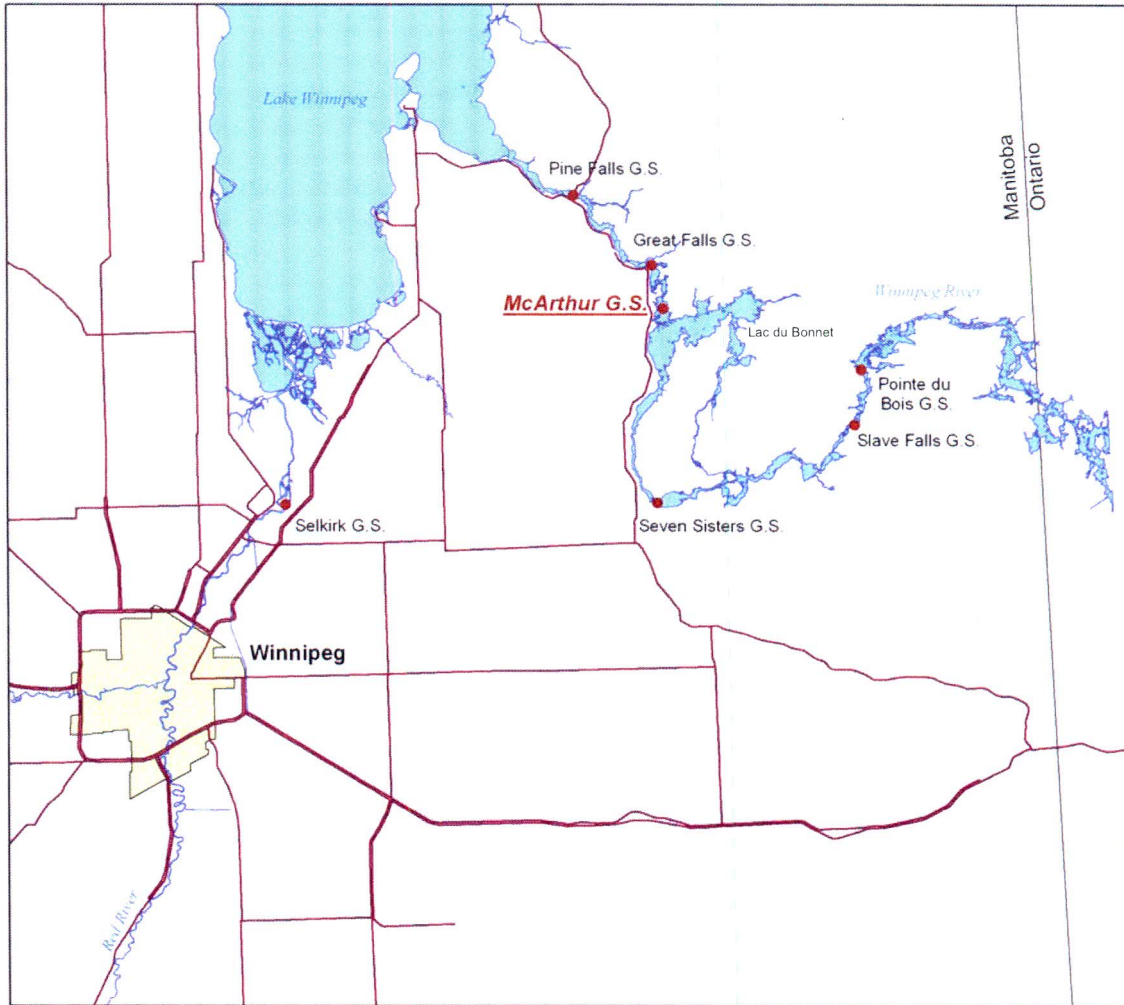


Figure 1: McArthur Falls Generating Station - General Location

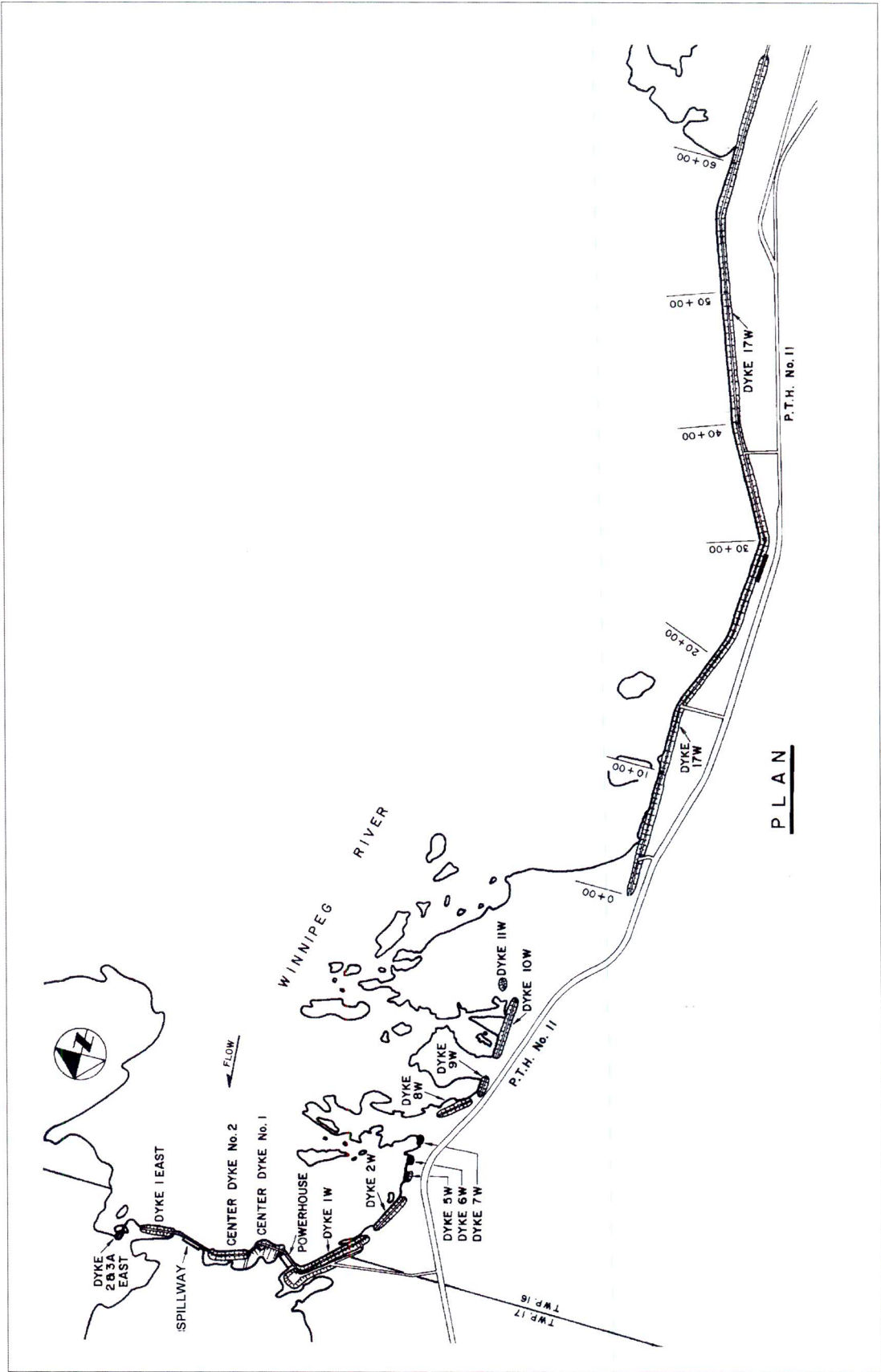


Figure 2: McArthur Falls Overall Site Map

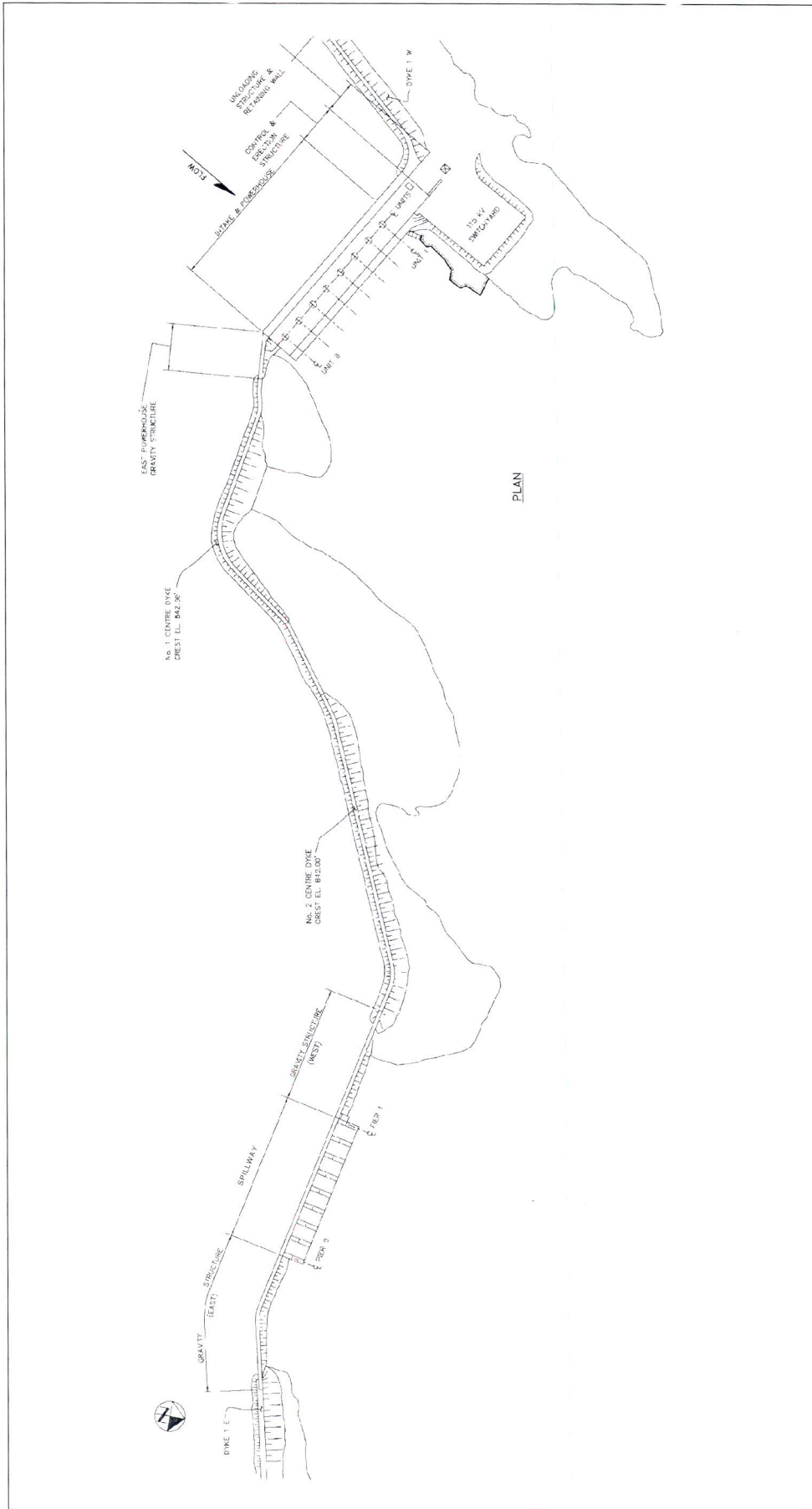


Figure 3: General Arrangement - Powerhouse and Spillway

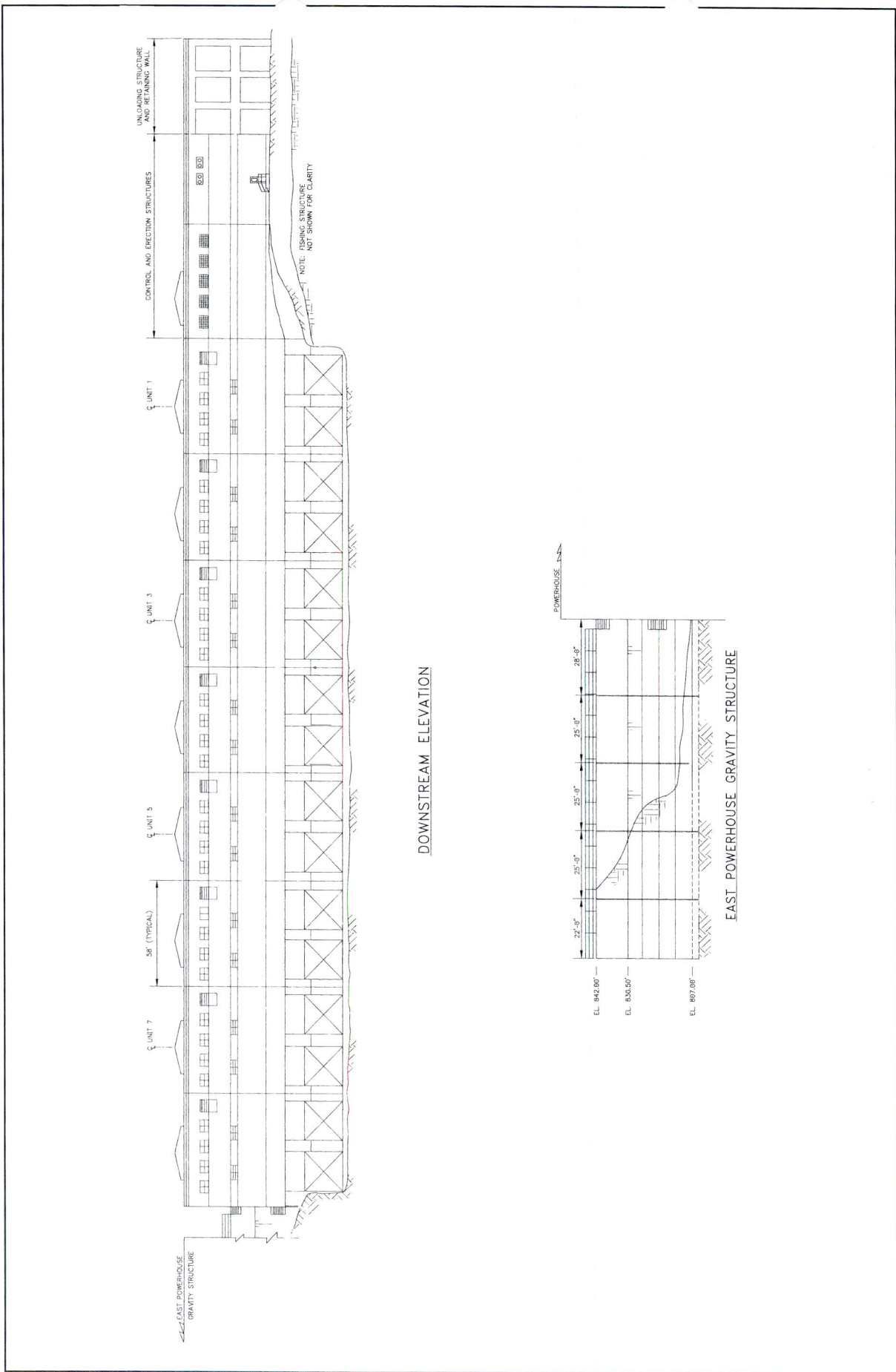


Figure 4: Powerhouse and East Powerhouse Gravity Structure - Downstream Elevation

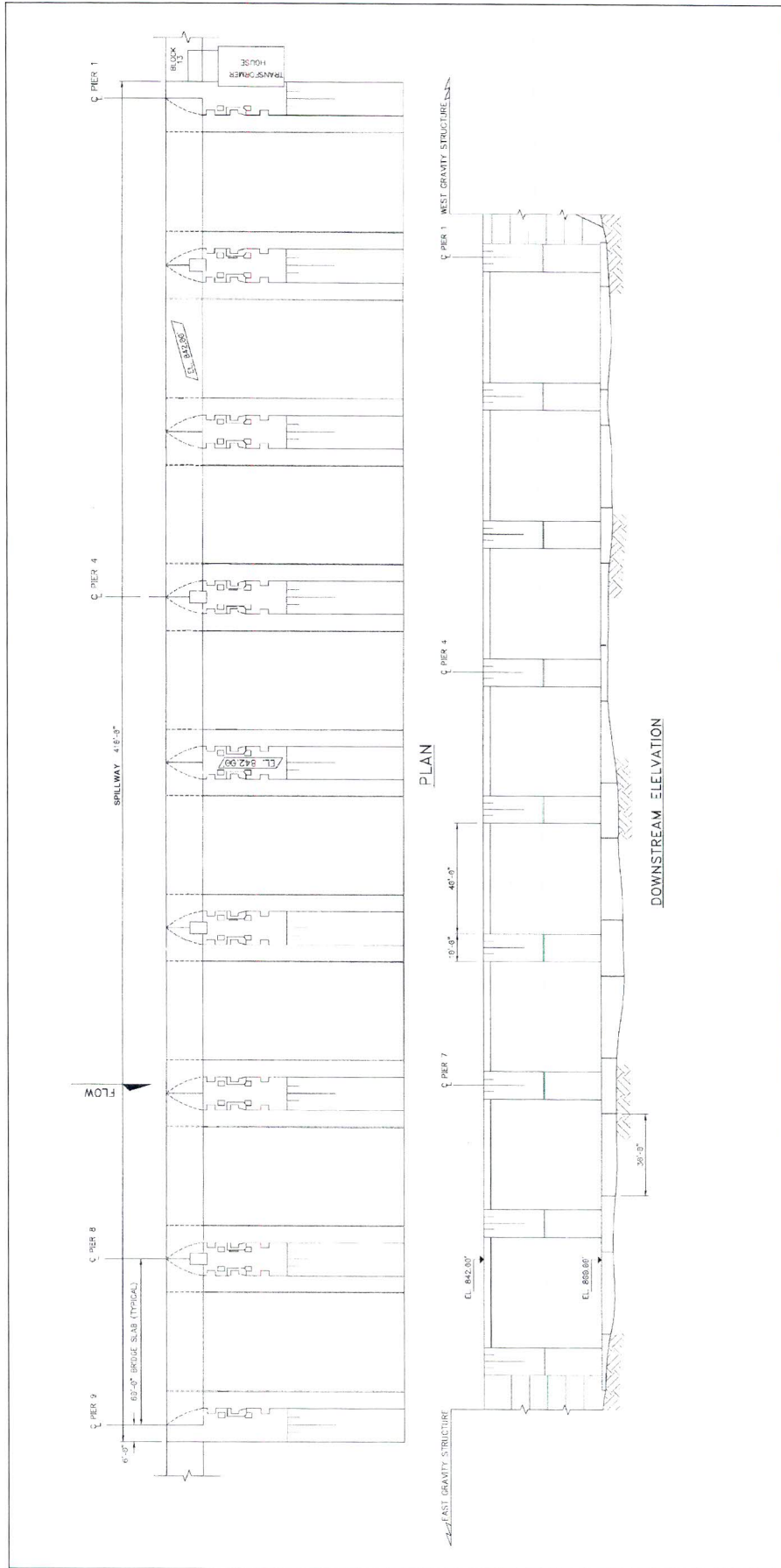


Figure 5: Spillway Structure - Plan and Elevation

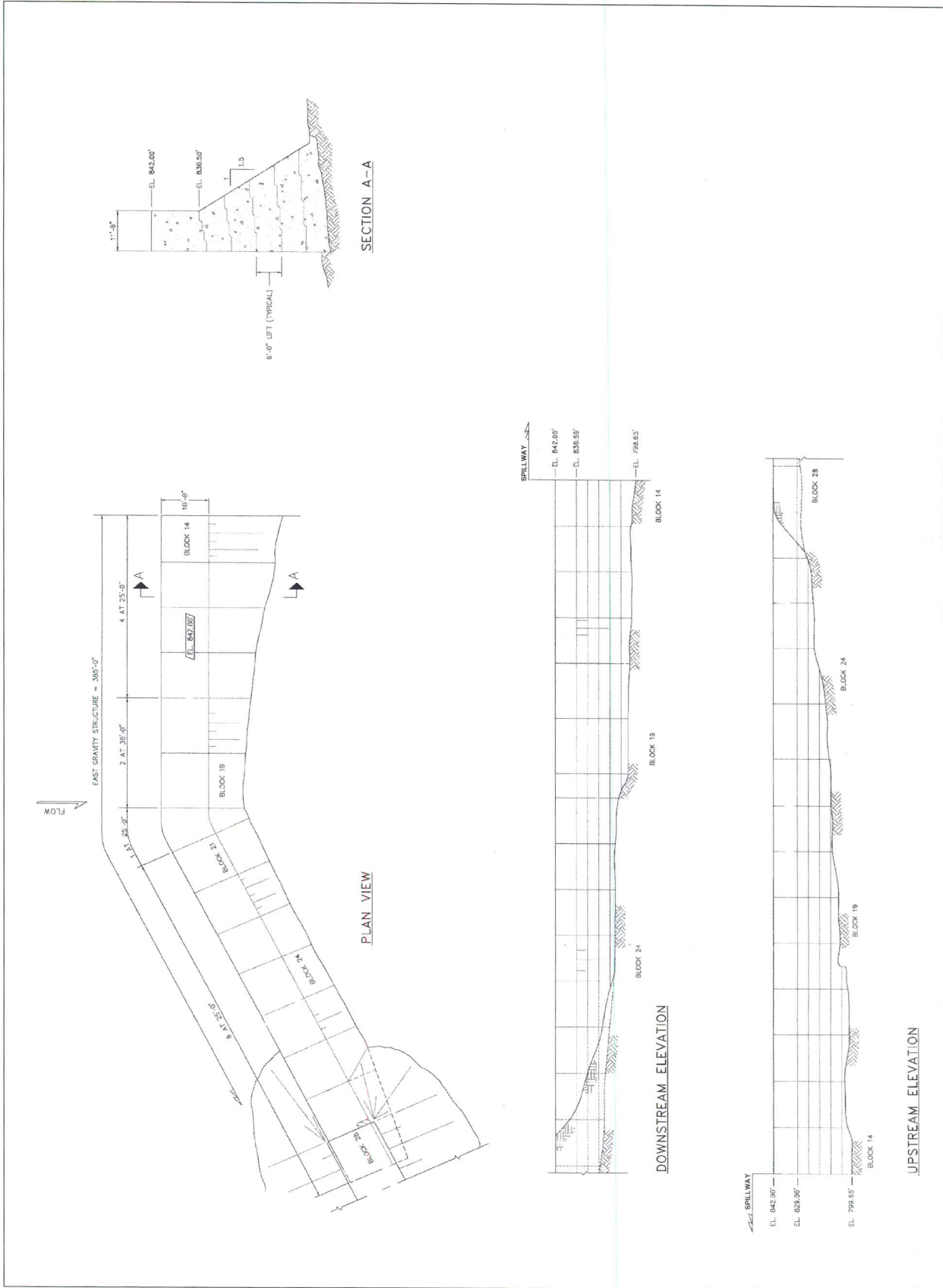


Figure 6: East Gravity Structure - Plan and Elevation

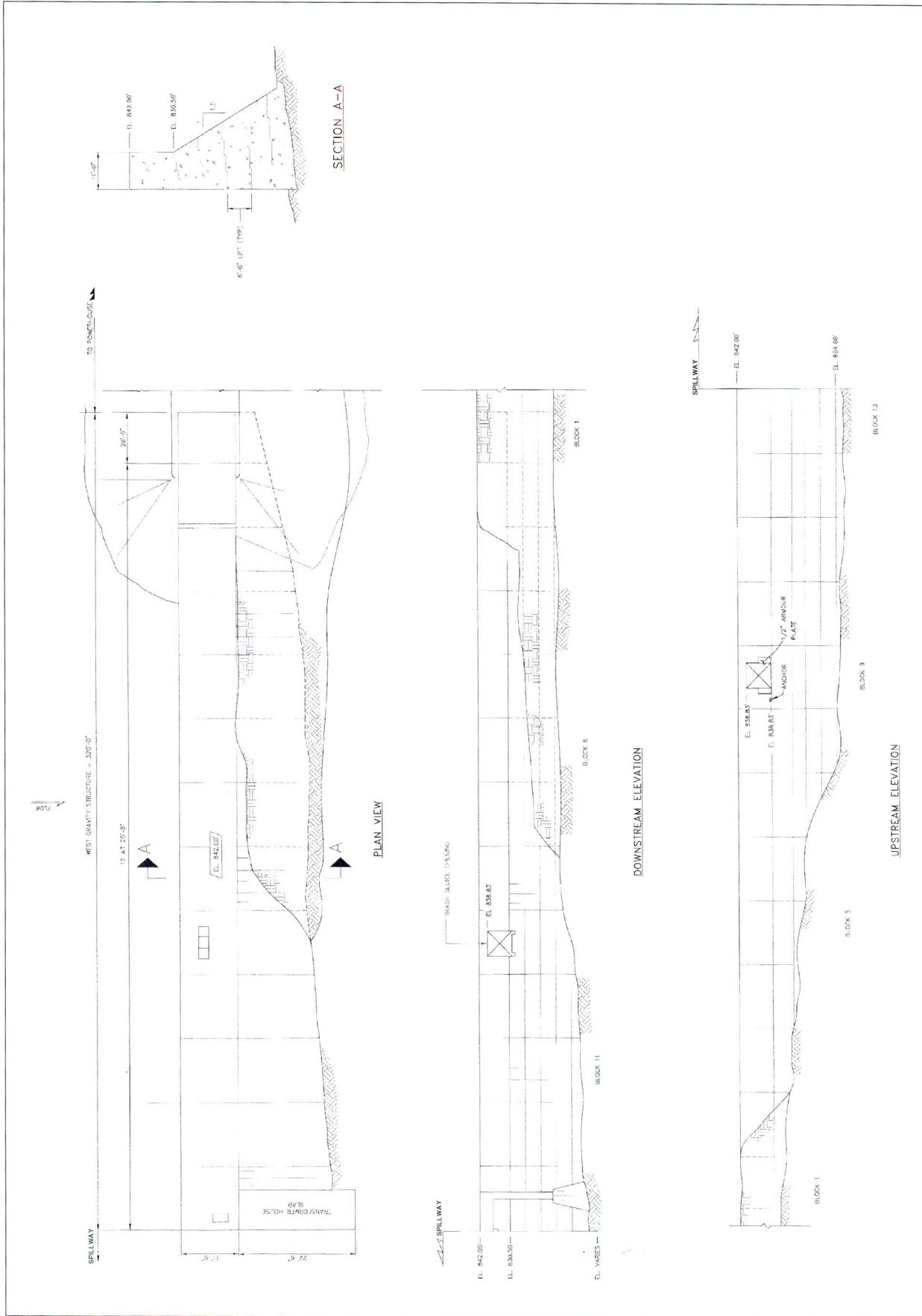


Figure 7: West Gravity Structure - Plan and Elevation

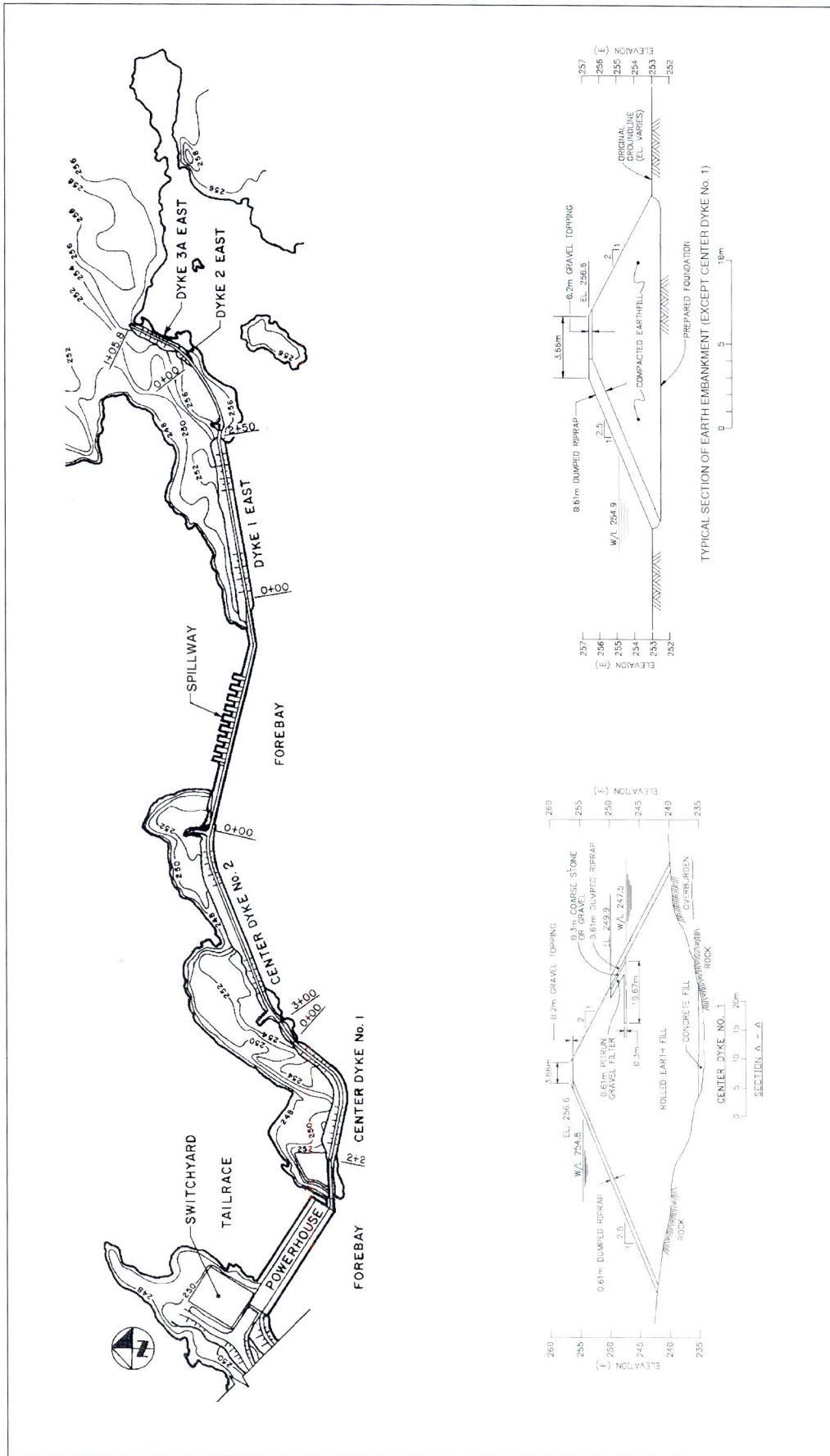


Figure 8: East and Center Dykes - Plan and Typical Cross Section

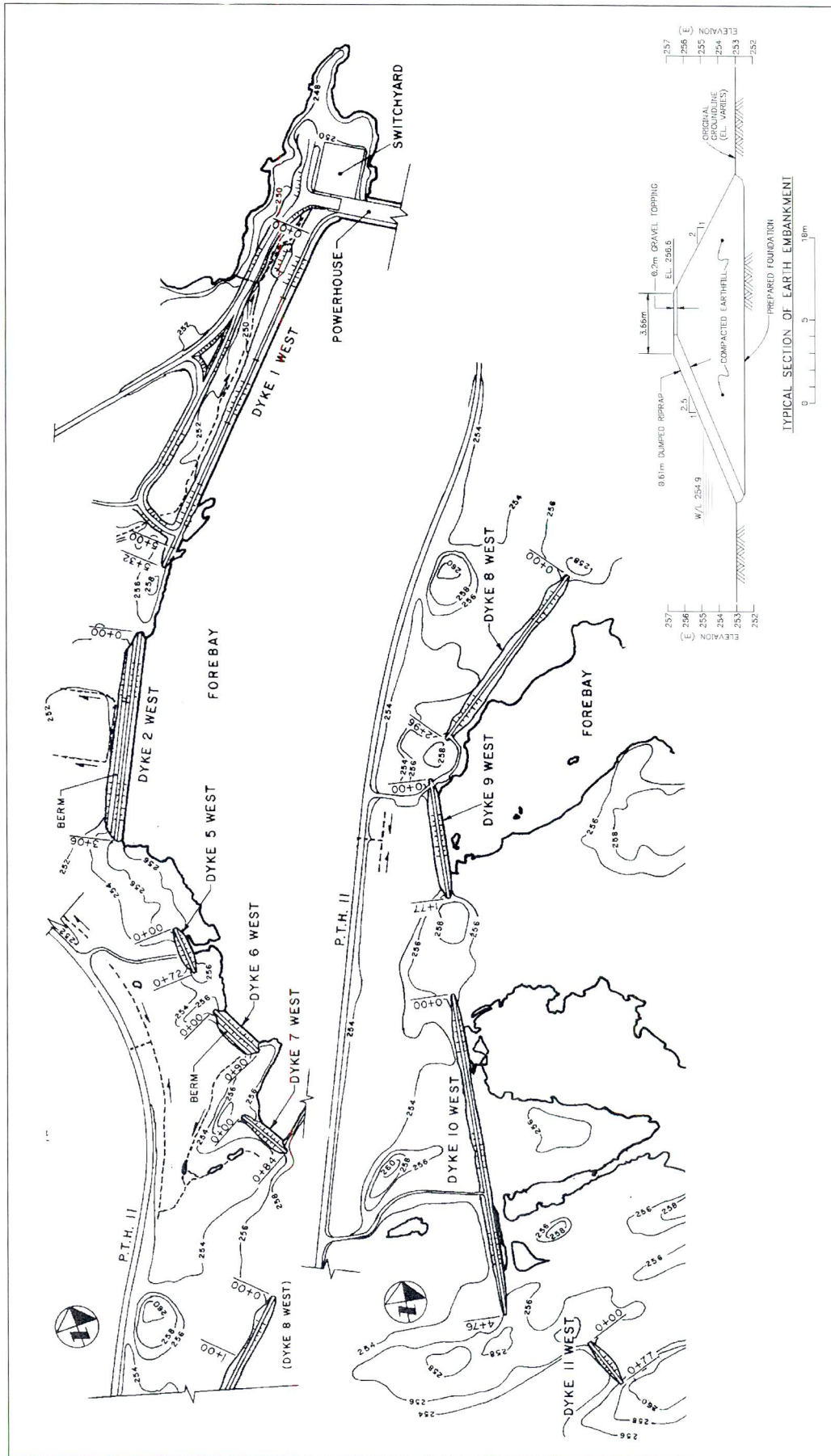


Figure 9: West Dykes (1 to 11) - Plan and Typical Cross Section

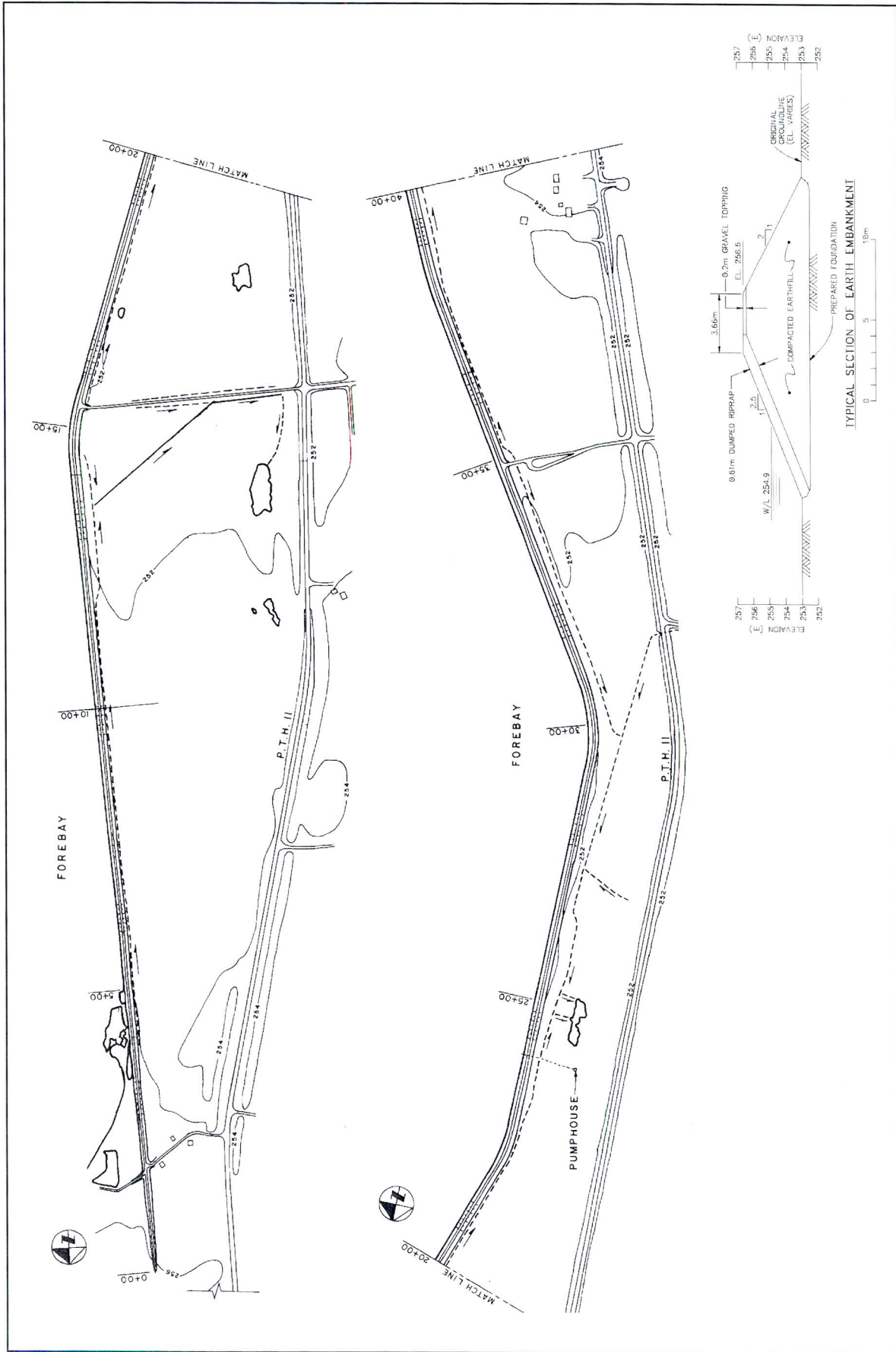


Figure 9a: 17W Dyke - Plan and Typical Cross Section

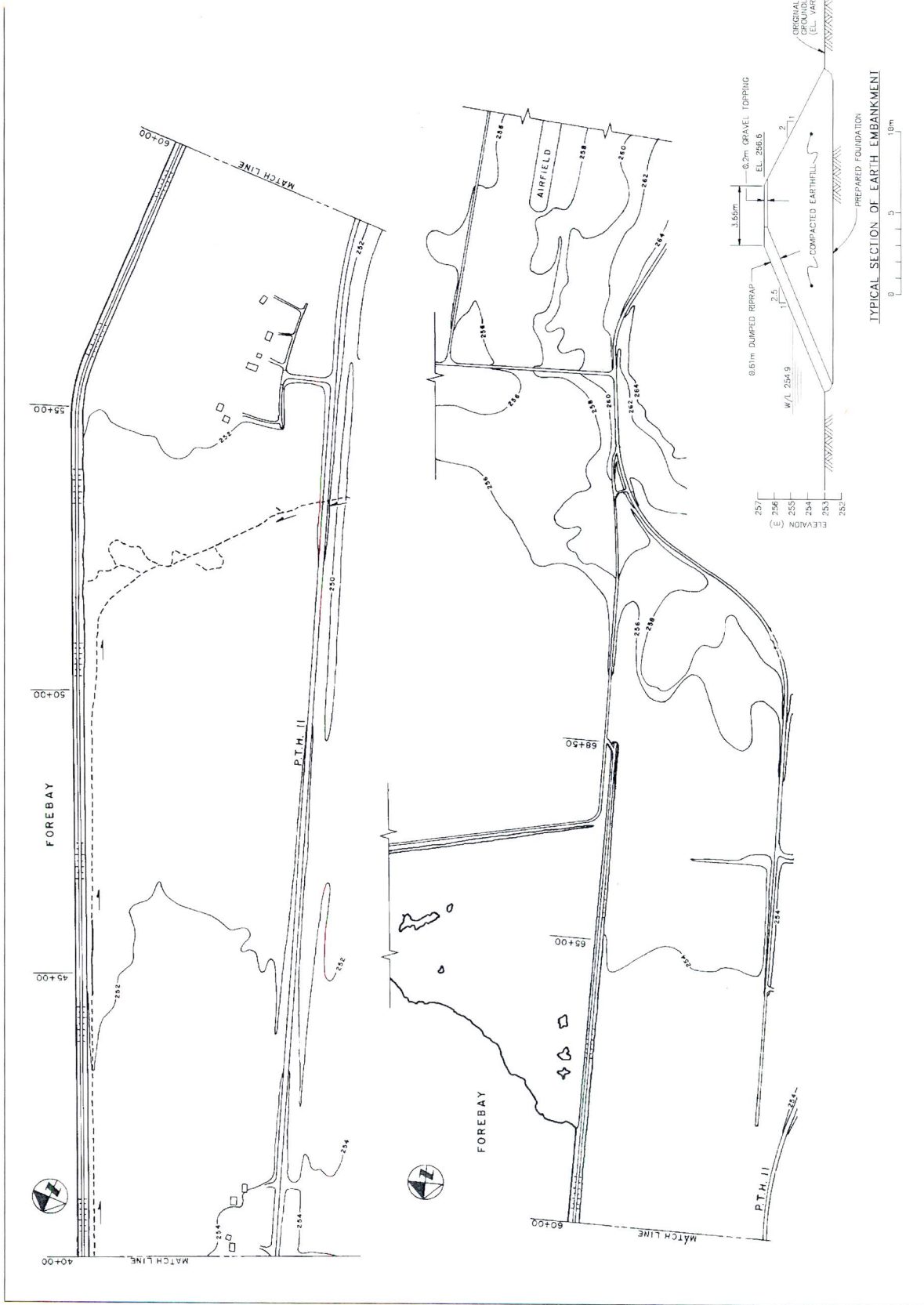


Figure 9b: 17W Dyke Con't - Plan and Typical Cross Section



Photograph 1: McArthur Falls Generating Station