MACAE MERCHANT THERMAL POWER PLANT

Modification of the Original Project

elpaso Energy International

ECOLOGUS
Engenharia Consultiva

December / 2001

elpaso Energy International

Rio de Janeiro, 20 de dezembro de 2001

À
FEEMA

At. Dra. Isaura Fraga – Presidente da FEEMA
cc. Dra. Silvia Carneiro – Coordenadora do Grupo de Trabalhos de Termoelétricas

Ref: Usina Termoelétrica Macaé Merchant

Prezados Senhores,

Vimos pela presente submeter à FEEMA o pedido de modificação em nosso projeto original, de forma a possibilitar o aumento de potência na UTE Macaé Merchant.

Tal modificação é justificada pela necessidade de atendimento às perspectivas nacionais da Câmara de Gestão da Crise de Energia Elétrica - GCE, que definiu a utilização em 2002 de parcela significativa de energia a partir das temoelétricas emergenciais. A UTE Macaé Merchant, encontra-se no momento em final de implantação com possibilidade de colocação no sítio, sem prejuízos ambientais, de mais quatro unidades de turbogeradores, de características idênticas às já licenciadas permitindo gerar 170 MW adicionais. Esta modificação no projeto, feita de imediato, permitirá a disponibilização desta energia já no mês de julho de 2002, para a região Sudeste, atendendo as necessidades previstas pela GCE.

Assim, encaminhamos em anexo documentação para suporte à aprovação de V.Sas, e colocamo-nos a disposição para quaisquer informações adicionais necessários.

Atenciosamente,

Nelson Bustamante
Gerente de Meio Ambiente

FEEMA
Central de Atendimento
RECEBIDO EM 20/12/01

El Paso Energy International do Brasil Ltda.
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TRANSLATION

Rio de Janeiro, December 20th, 2001

To
FEEMA
c/o Dr. Isaura Fraga – President of FEEMA
Copied to Dr. Silvia Carneiro – Coordinator of the Thermal Power Plants Team

Ref.: Macaé Merchant Thermal Power Plant

Dear Sir

This letter addresses our formal request to FEEMA for changing the original project of Macaé Merchant TPP, in order to allow increasing the plant power.

This change is justified by the need on meeting the national perspectives of the Câmara de Gestão da Crise de Energia Elétrica – GCE, which has defined the utilization of a significant part of energy from emergencial thermal power plants, in 2002. Macaé Thermal Power plant is presently under implementation and the installation of four new GTGs in the site is fully feasible and would not result on any additional environmental impacts. Those GTGs would be identical to the licensed ones, allowing adding 170 MW to the rated capacity of the plant. These changes on the original project would allow this additional power to be available from July, 2002 on, meeting the needs anticipated by GCE.

Therefore, find attached the documentation required for supporting your approval. We are ready to provide any additional information required about this subject.

Best regards,

Nelson Bustamante
Environmental Manager

MODIFICATION TO THE GENERATING OUTPUT OF MACAÉ MERCHANT THERMOELECTRIC PLANT

1- JUSTIFICATION

The Macaé Merchant Thermoelectric Plant was initially designed to operate at a maximum output of 700 MW. During the period between the initial planning of the project and the current phase of construction, the Brazilian electricity generating panorama became even more critical, culminating with the adoption of a nationwide rationing program. The situation led El Paso to consider a modification to the generating output of the original design of Macaé Merchant Thermoelectric Plant, which had already been licensed by FEEMA. This modification will basically consist of installing four more GE LM-6000 type turbine generating units, with the same characteristics as those already installed, which would enable the plant to attain a maximum output of 870 MW. The modification to the power output of Macaé Merchant Thermoelectric Plant will contribute towards increasing the supply of power in the Side-Southeast-Midwest region, one of the most affected in the context of the current energy crisis.

2- ENVIRONMENTAL EVALUATION

The planned modification was designed in such a way as to optimize the existing installations and units to the maximum, and to minimize the environmental impacts in the project area. Therefore the following impact factors were evaluated:

- ✓ ***Earthmoving***: the 4 new turbine-generating units will be located at the rear part of the site, behind the units already constructed. (see drawings G-1, G-060 and XX-1). In order to extend the existing plateau it will be necessary to carry out earthmoving over an area of around 1.3 ha. The earthmoving services will be predominantly in cut, with a volume of around 121,500 m^3 and a fill volume of around 8,415 m^3. The surplus material will be entirely disposed of within the El Paso site, at the location previously authorized for this purpose by FEEMA. The area where the earthmoving will be carried out does not have any tree cover, but only pasture. The works to be carried out immediately will result in lower impacts, since the project is still underway, and the modification can be carried out using the equipment and personnel already mobilized on the site and familiar with the requirements of FEEMA related with the environmental care necessary for construction. All the constraints defined in LI 125/2001 for the works will be observed.

- ✓ ***Water Consumption and Discharge of Liquid Effluents***: The modification to the design will not generate any additional demand for water. Therefore no alteration will be made to the existing water intake structure; neither will it be necessary to request an extension of the license. In the same way, the water treatment and effluent treatment units will not be altered. Therefore there are no changes to the impacts related with consumption of water from the River Macaé and the discharge of effluents. As a result the water and effluent monitoring programs for the thermoelectric plant continue to be valid, and therefore the restrictions of the Operating License - LO relating to this issue will be maintained.

- ✓ ***Environmental Risk***: The expansion foresees the same kind of safety equipment, units and systems already evaluated in the risk analysis presented in the EIA, and therefore does not imply any alteration to the risks established in the analysis.

- ✓ ***Noise Emissions:*** Bearing in mind the increase in the number of noise emission sources, the modification to the project alters the conditions previously evaluated in relation to this impact factor. As a result, a new evaluation was performed, carrying out new computer modeling. In this modeling, in addition to the four new units, the new configuration of the plant site was incorporated into the model, which was considerably expanded by the acquisition of land bordering the original site, resulting in an increase in area from 100 ha to 300 ha. The result of the modeling, shown attached, indicates acceptable noise levels at the boundaries of the site, consistent with the standards allowed under the relevant environmental legislation. It should be stressed that the fact that El Paso has acquired additional land, as recommended in the EIA, resulted in the impact related with noise emissions being reduced in relation to the original design. Therefore the noise level monitoring program foreseen in restriction 14 of LO 439/2001 continues to be valid.

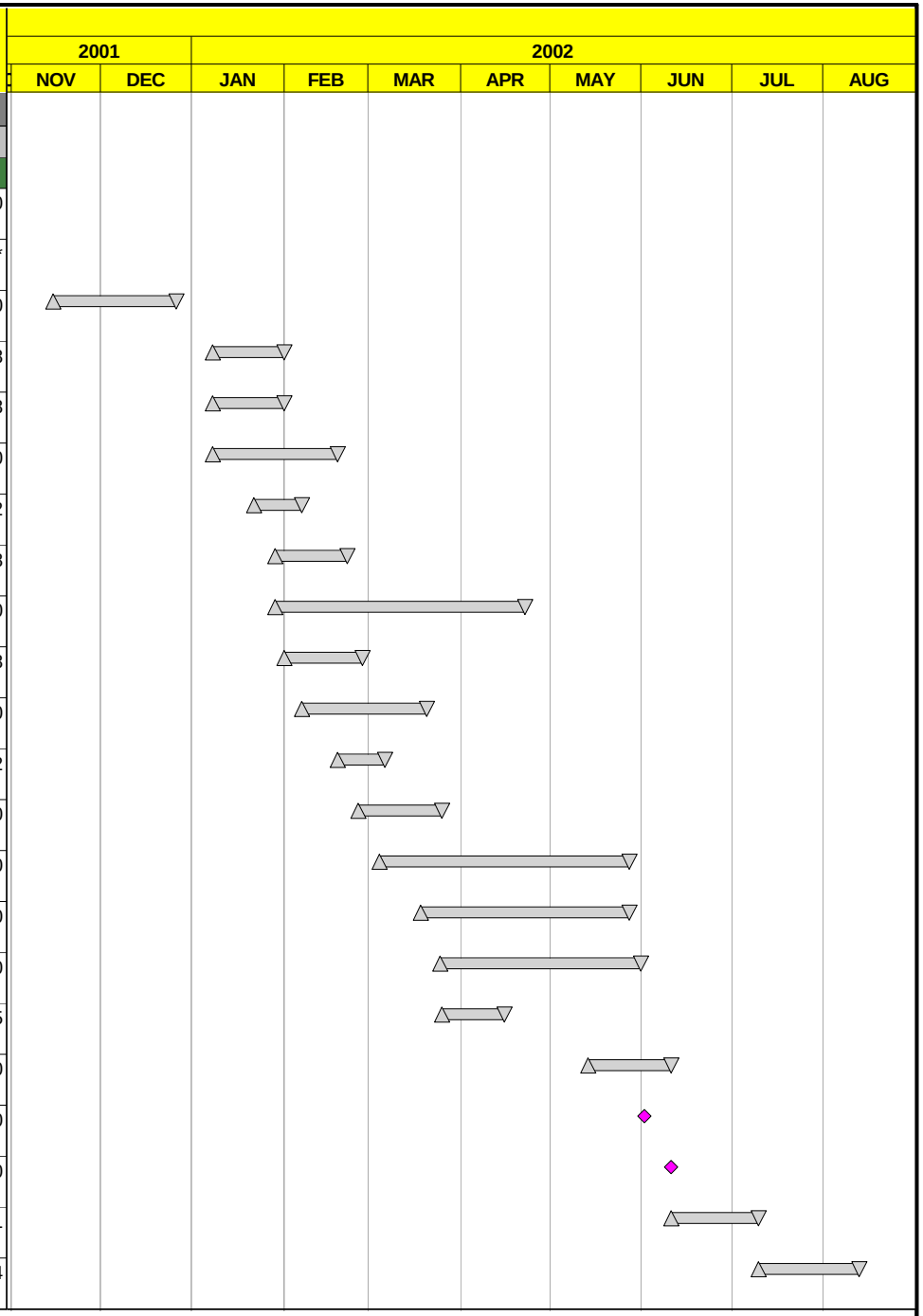
- ✓ ***Atmospheric Emissions:*** Bearing in mind the four new units in addition to the 16 originally considered, a revaluation of the environmental impacts caused by emissions from the plant was performed, adopting the same analysis approach used in the previous studies. For this purpose new modeling was performed considering 20 smokestacks for the Macaé Merchant project, analyzed jointly with the three smokestacks planned for the Norte Fluminense Thermoelectric Plant. The results presented in attachment demonstrate that even under the most critical meteorological conditions, the new configuration generates pollutant concentrations at ground level lower than the maximum limits allowed under the relevant legislation. It can also be seen that the maximum concentration points resulting from the emissions of the new plant configuration coincide with those generated by the previous configuration. Therefore the current modification to the design adopts the same emission monitoring concept approved by FEEMA in LI 125/2001, incorporating one more CEMS device

in addition to the four originally planned, in such a way that the new group of turbine generators has a continuous monitoring system identical to the four groups already licensed. Restrictions 9,10,11, 12 and 13 of LO 439/2001 related with the air quality and atmospheric emissions will be observed.

3- CONCLUSION

Based on the evaluations performed it can be observed that from an environmental point of view the intended design modification does not introduce any additional impacts that cannot be adequately mitigated and controlled, observing the restrictions of LI 125/2001 during installation of the planned modifications and maintaining all the restrictions of LO 439/2001 applicable during the operational phase.

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
BRAZIL				
CONSTRUCTION				
50000	Qualify Brazil Contractors	29JAN01A	26FEB01A	40
50010	On-Site Const Mgmt	29JAN01A	30MAR01A	40*
5045	Clear Site / Grade (By Others)	15NOV01*	26DEC01	30
5065	Chiller Foundations	08JAN02	31JAN02	18
5095	Electrical Building Foundations (3)	08JAN02	31JAN02	18
5055	CTG's 17 - 20 & Assc. Equip. Fdns.	08JAN02	18FEB02	30
5085	Transformer Foundations	22JAN02	06FEB02	12
5075	Pipe Rack Foundations	29JAN02	21FEB02	18
5135	Install CTG's 17 - 20	29JAN02	22APR02	60
5185	Install Chillers	01FEB02	26FEB02	18
5205	Install Transformers	07FEB02	20MAR02	30
5115	Erect Pipe Rack Steel	19FEB02	06MAR02	12
5105	Install U/G Pipe	26FEB02	25MAR02	20
5125	Fab & Install A/G Pipe & Test	05MAR02	27MAY02	60
5155	Install Instruments	19MAR02	27MAY02	50
5145	Install Electrical	25MAR02	31MAY02	50
5195	Install Electrical Bldgs. (3)	26MAR02	15APR02	15
5165	Pre-commissiong & Commissioning	14MAY02	10JUN02	20
5235	Mechanical Completion		01JUN02*	0
5215	READY for PRODUCTION		10JUN02	0
5225	Final Completion	11JUN02	09JUL02	21
5999	De-mobilization	10JUL02	12AUG02	24



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Finish Date 12AUG02
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El Paso Macae Power Project
Power Block 5
Master Project Schedule

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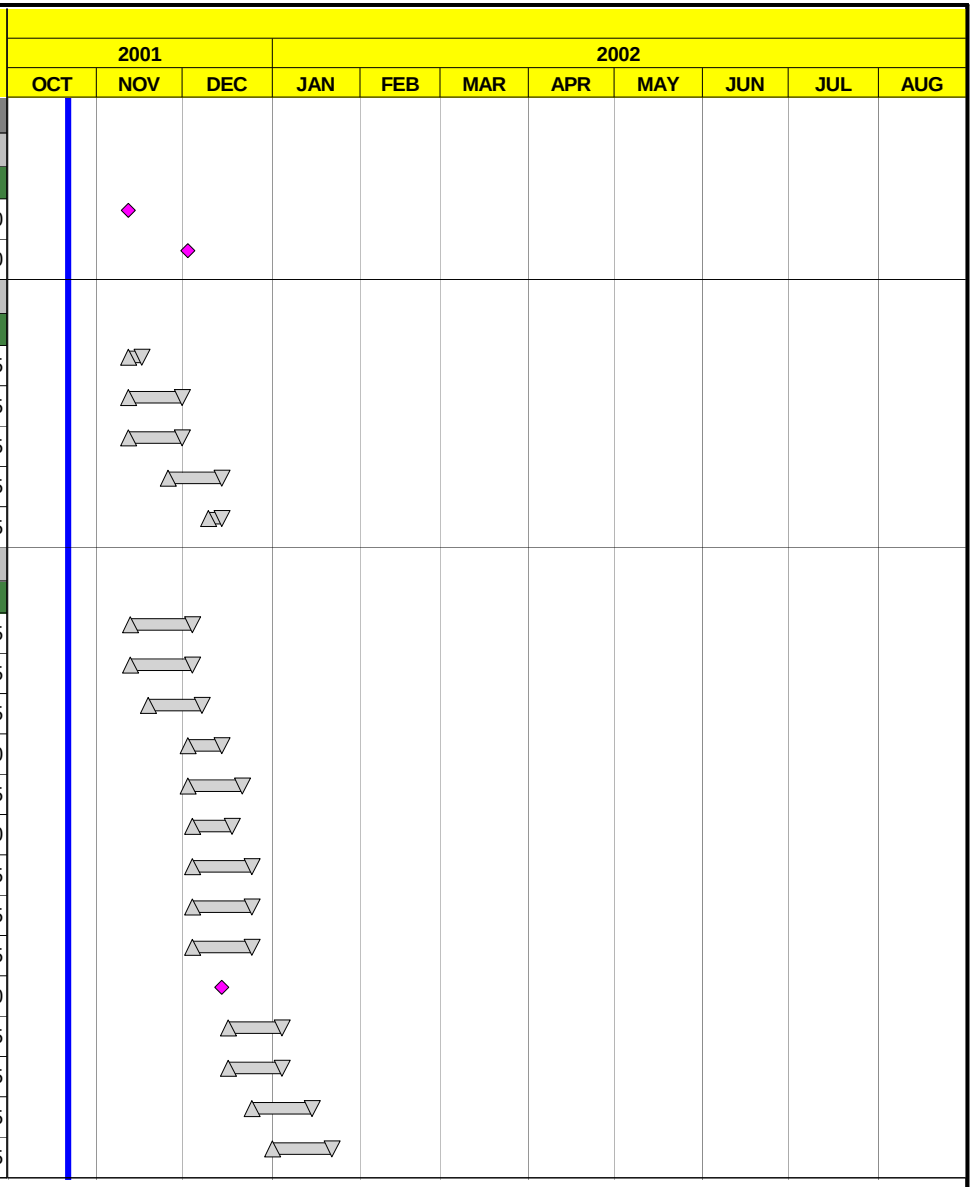
Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
HOUSTON				
PROJECT MANAGEMENT / ENGINEERING				
5012	El Paso Release Pwr. Blk. #5 Design	12NOV01*		0
5010	Contract	03DEC01*		0
PROCESS				
5020	Design Basis	12NOV01	16NOV01	5
5030	Flow Diagrams	12NOV01	30NOV01	15
5050	Instrument Data Sheets	12NOV01	30NOV01	15
5040	Line List	26NOV01	14DEC01	15
5060	Hydraulic Checks	10DEC01	14DEC01	5
CIVIL STRUCTURAL & ARCHITECTURAL				
5330	Site Grading & Drainage Plans & Details	13NOV01	03DEC01	15
5460	Pipe Rack Steel Dwgs	13NOV01	03DEC01	15
5340	U/G Gravity Piping Plans & Details	19NOV01	07DEC01	15
5420	U/G MTO & Requisitions	03DEC01	14DEC01	10
5490	Misc. Pipe Support Steel	03DEC01	21DEC01	15
5400	Pipe Rack Fdns	04DEC01	17DEC01	10
5350	CTG & Assoc. Equipment Fdns Dwgs	04DEC01	24DEC01	15
5360	Chiller & CT Fdn. Dwgs	04DEC01	24DEC01	15
5390	Mod. Elect Bldg Fdn.	04DEC01	24DEC01	15
5320	Obtain Soils Analyisis from El Paso		14DEC01*	0
5495	Bldg. Support Steel Dwgs	17DEC01	04JAN02	15
5500	Misc. Pipe Support Foundations	17DEC01	04JAN02	15
5480	Xfmr. Foundations	25DEC01	14JAN02	15
5410	Misc Fdns.	01JAN02	21JAN02	15



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Finish Date	12AUG02
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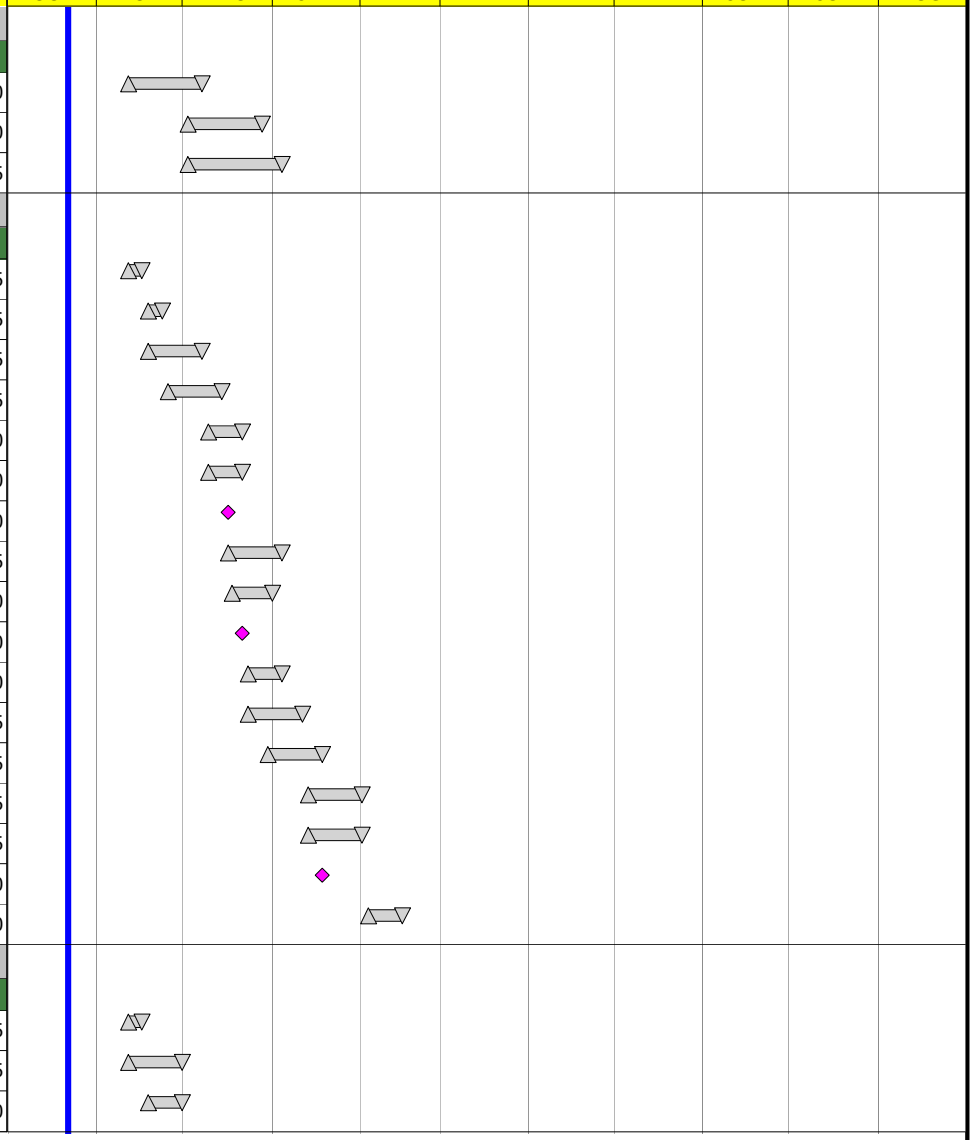
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
MECHANICAL				
5160	Equipment Specifications	12NOV01	07DEC01	20
5430	Stress Analysis	03DEC01	28DEC01	20
5170	Equipment Requisitions	03DEC01	04JAN02	25
P C S				
5290	Mod. Electrical Bldg Requisition	12NOV01	16NOV01	5
5180	Electrical Design basis	19NOV01	23NOV01	5
5230	Electrical One Lines	19NOV01	07DEC01	15
5190	Electrical Duct Bank / Plot Plans	26NOV01	14DEC01	15
5270	Instrument Location Drawings	10DEC01	21DEC01	10
5300	Electrical Equipment Requisitions	10DEC01	21DEC01	10
5280	Bulk Material Requisitons - 90 %	17DEC01		0
5310	Instrument List / Requisitions	17DEC01	04JAN02	15
5220	Cable Tray Details	18DEC01	31DEC01	10
5450	Receive Grounding Info from Outside Study		21DEC01*	0
5210	Grounding Details	24DEC01	04JAN02	10
5240	Cable Schedule	24DEC01	11JAN02	15
5200	Electrical Lighting Plans & Details	31DEC01	18JAN02	15
5260	Panel Drawings	14JAN02	01FEB02	15
5265	PLC Configuration	14JAN02	01FEB02	15
5285	Bulk Material Requisitons - Final		18JAN02	0
5250	Termination Diagrams	04FEB02	15FEB02	10
PIPING				
5070	Plant Arrangement Plan	12NOV01	16NOV01	5
5120	Pipe Plans & Details - Pipe Rack Area	12NOV01	30NOV01	15
5080	CTG Arrangement	19NOV01	30NOV01	10



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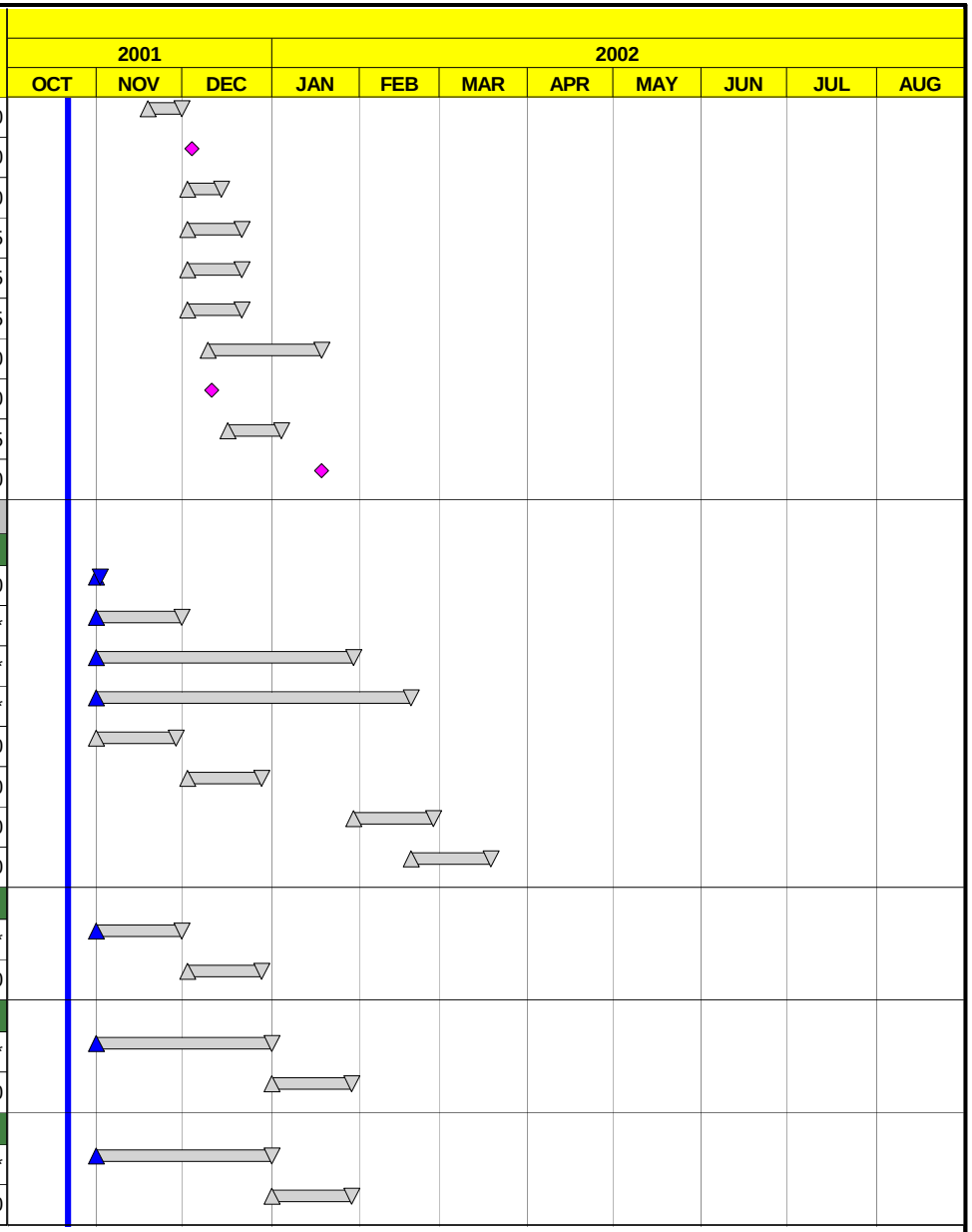
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
5130	Pipe Plans & Details - Water Treatment Area	19NOV01	30NOV01	10
5380	Obtain Site Coordinates from El Paso		03DEC01*	0
5090	Chiller/Cooling Twr Arrangements	03DEC01	14DEC01	10
5110	Pipe Plans & Details - CTG Area	03DEC01	21DEC01	15
5140	U/G Utility Pipe Plans & Details	03DEC01	21DEC01	15
5150	U/G Fire Water Pipe Plans & Details	03DEC01	21DEC01	15
5445	Prepare & Issue Piping Isometrics	10DEC01	18JAN02	30
5440	MTO - 90 %	11DEC01		0
5100	Pipe Plans & Details - Chiller Area	17DEC01	04JAN02	15
5443	MTO - 100 %		18JAN02	0
PROCUREMENT / EXPEDITING				
COMBUSTION TURBINE-GENERATOR & ASSOC EQUIP (MR 4				
5940	Fabricate CTG#17 / Assc. Equip	01NOV01A	01NOV01A	20
5950	Fabricate CTG#18 / Assc. Equip	01NOV01A	30NOV01	22*
5960	Fabricate CTG#19 / Assc. Equip	01NOV01A	29JAN02	64*
5970	Fabricate CTG#20 / Assc. Equip	01NOV01A	18FEB02	78*
5005	Ship/Customs/Deliver CTG#17 / Assc. Equip	01NOV01*	28NOV01	20
5015	Ship/Customs/Deliver CTG#18 / Assc. Equip	03DEC01	28DEC01	20
5025	Ship/Customs/Deliver CTG#19 / Assc. Equip	30JAN02	26FEB02	20
5035	Ship/Customs/Deliver CTG#20 / Assc. Equip	19FEB02	18MAR02	20
FUEL GAS HEATER				
5590	Fabricate Gas Heater _ Flowtronex	01NOV01A	30NOV01	22*
5600	Ship/Customs/Del Gas Heater	03DEC01	28DEC01	20
COALESCER/FILTER				
5570	Fabricate Separator - Anderson	01NOV01A	31DEC01	43*
5580	Ship/Customs/Del Separator	01JAN02	28JAN02	20
GAS TURBINE INLET AIR CHILLERS				
5530	Fabricate Chillers - Turbines Air System	01NOV01A	31DEC01	43*
5540	Ship/Customs/Del Chillers	01JAN02	28JAN02	20



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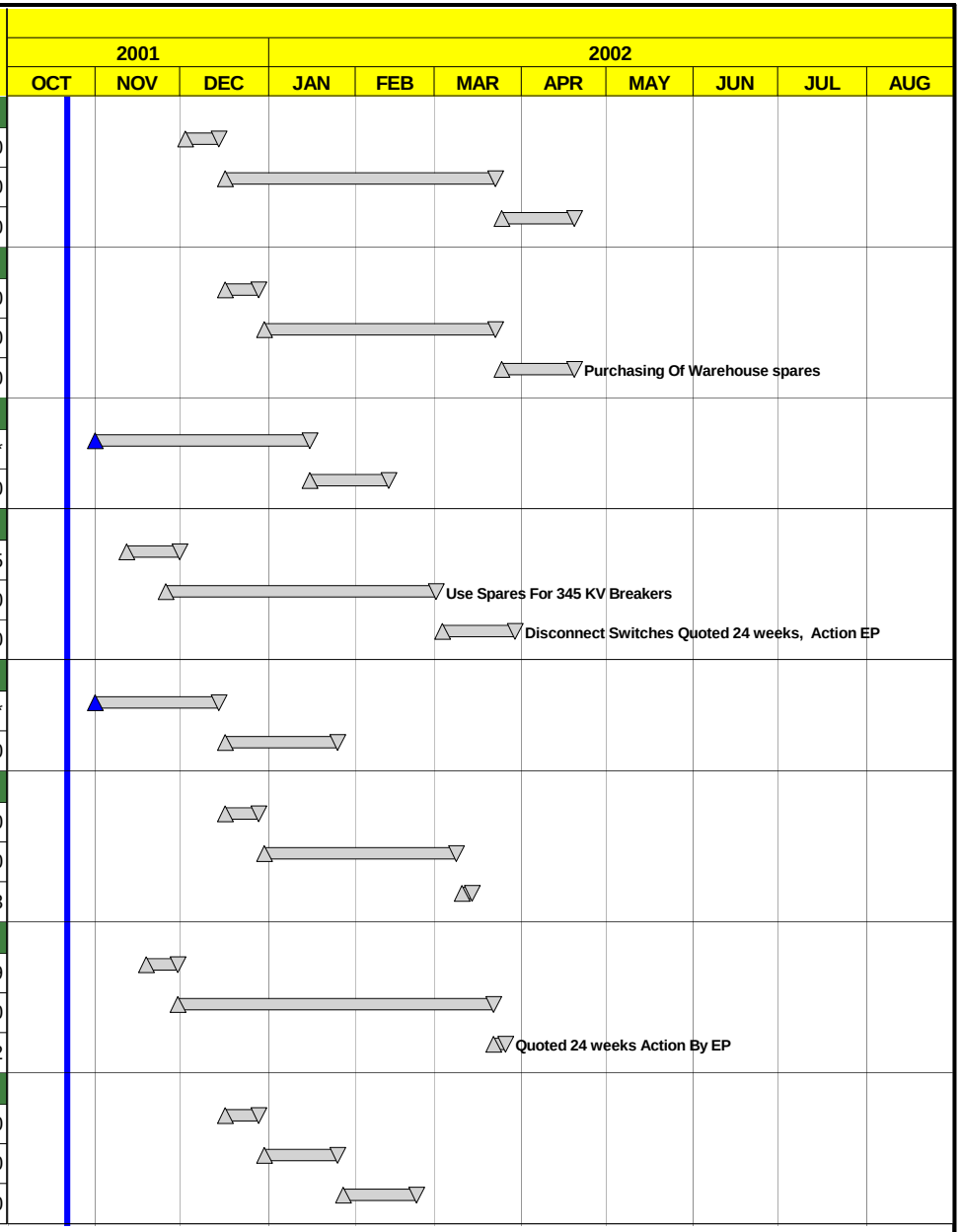
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
AIR COMPRESSOR SYSTEM				
5700	Req. / Place PO Air Compressor	03DEC01	14DEC01	10
5710	Fabricate Air Compressor	17DEC01	22MAR02	70
5720	Ship/Customs/Del Air Compressor	25MAR02	19APR02	20
WATER INJECTION PUMPS				
5670	Req. / Place PO - Water Injection Pumps - GE	17DEC01	28DEC01	10
5680	Fabricate water Injection Pumps	31DEC01	22MAR02	60
5690	Ship/Customs/Del Water Injection Pumps	25MAR02	19APR02	20
EXHAUST STACKS				
5550	Fabricate Stacks - Braden Mfg.	01NOV01A	15JAN02	54*
5560	Ship/Customs/Del Stacks	16JAN02	12FEB02	20
DISCONNECT SWITCHES & 345 KV BREAKERS				
5790	Req. / Place PO Disconnect Switches - ABB	12NOV01	30NOV01	15
5800	Fabricate Diconnect Switches (14 Weeks)	26NOV01	01MAR02	70
5810	Ship/Customs/Deliver Disconnect Switches	04MAR02	29MAR02	20
TRANSFORMER - (STEP-UP)				
5510	Fabricate GSU Transformers - Crompton Greaves	01NOV01A	14DEC01	32*
5520	Ship/Customs/Del GSU Transformers	17DEC01	25JAN02	30
AUXILIARY TRANSFORMERS				
5610	Req. / Place PO Aux. Xfmr	17DEC01	28DEC01	10
5620	Fabricate Aux Xfmrs. - Siemens Brazil	31DEC01	08MAR02	50
5630	Deliver Aux Transformers	11MAR02	13MAR02	3
MODULAR ELECTRICAL BLDG. INCL BUS FOR AUX XFMRS				
5640	Req./Place PO Mod Elect Bldg/Swgr/Bus	19NOV01	29NOV01	9
5650	Fab Mod. Elect. Bldg./Swgr (16 Weeks)	30NOV01	21MAR02	80
5660	Deliver Modular Elect Bldg/Swgr	22MAR02	25MAR02	2
ELECTRICAL BULKS				
5880	Req. / Place PO Electrical Bulks	17DEC01	28DEC01	10
5890	Fabricate Electrical Bulks	31DEC01	25JAN02	20
5900	Ship/Customs/Deliver Electrical Bulks	28JAN02	22FEB02	20



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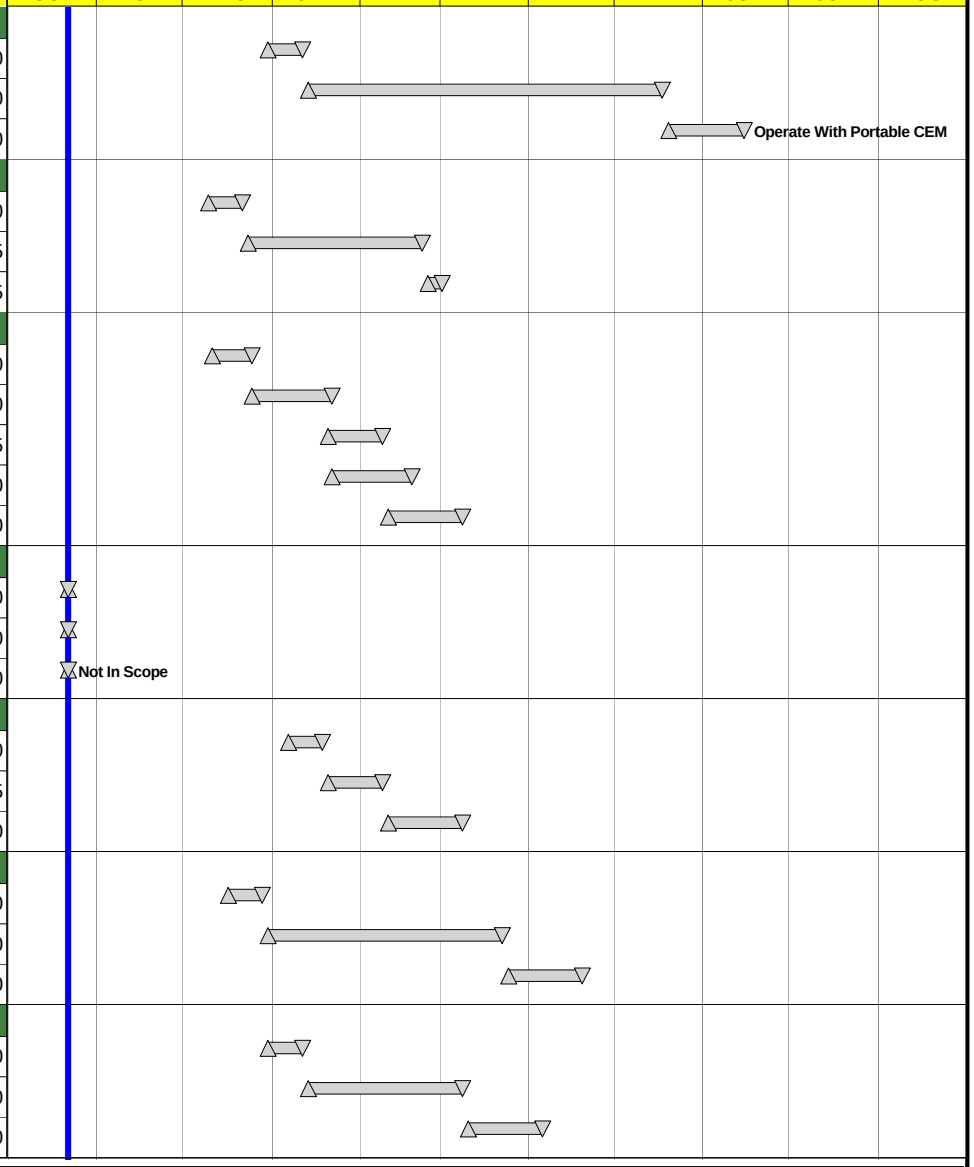
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
EMISSION MONITORING SYST.				
5730	Req. / Place PO CEMS - Siemens	31DEC01	11JAN02	10
5740	Fabricate CEMS	14JAN02	17MAY02	90
5750	Ship/Customs/Deliver CEMS	20MAY02	14JUN02	20
15 KV SWITCHGEAR/BUS DUCT				
6070	Req. / Place PO 15 KV Switchgear	10DEC01	21DEC01	10
6080	Fabricate Switchgear	24DEC01	22FEB02	45
6090	Ship/Customs/Deliver Switchgear	25FEB02	01MAR02	5
PIPE BULK MATERIAL				
5850	Req. / Place PO Piping Bulks	11DEC01	24DEC01	10
5860	Fabricate Pipe Bulks - 90 %	25DEC01	21JAN02	20
5865	Fabricate Pipe Bulks - Last 10 %	21JAN02	08FEB02	15
5870	Ship/Customs/Deliver Pipe Bulks - 90 %	22JAN02	18FEB02	20
5875	Ship/Customs/Deliver Pipe Bulks Last 10%	11FEB02	08MAR02	20
GAS CHROMATOGRAPH				
5820	Req. / Place PO Gas Chromatograph - Siemens			0
5830	Fabricate Gas Chromatograph			0
5840	Ship/Customs/Deliver Chromatograph			0
INSTRUMENT BULK MATERIAL				
5910	Req. / Place PO Instrument Bulks	07JAN02	18JAN02	10
5920	Fabricate Instrument Bulks	21JAN02	08FEB02	15
5930	Ship/Customs/Deliver Instrument Bulks	11FEB02	08MAR02	20
CATHODIC PROTECTION				
5980	Req. / Place PO Cathodic protection	17DEC01	28DEC01	10
5990	Fabricate Cathodic protection	31DEC01	22MAR02	60
6000	Ship/Customs/Deliver Cathodic Protection	25MAR02	19APR02	20
CCTV & GAITRONICS				
6010	Req. / Place PO CCTV & Gaitronics	31DEC01	11JAN02	10
6020	Fabricate CCTV & Gaitronics	14JAN02	08MAR02	40
6030	Ship/Customs/Deliver CCTV & Gaitronics	11MAR02	05APR02	20



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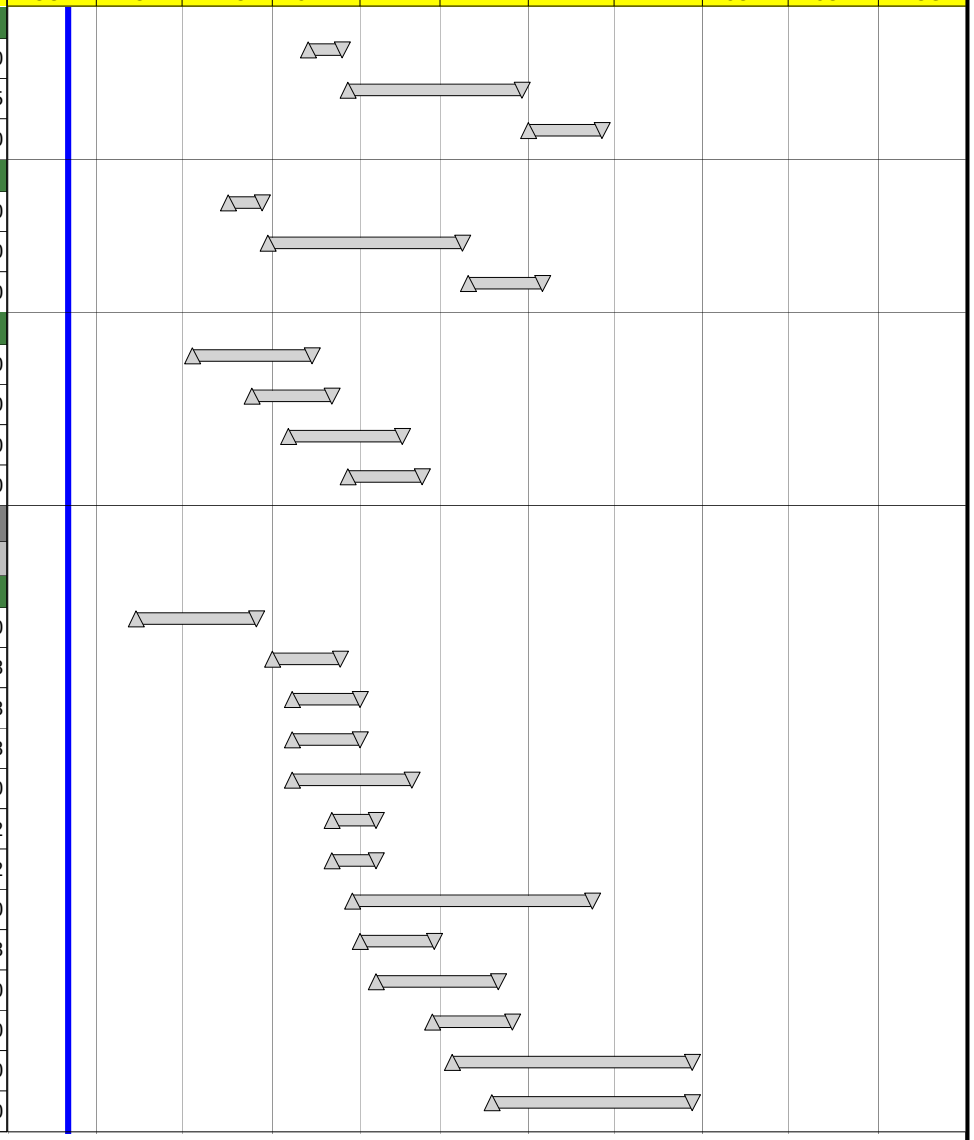
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
RTU BLOCK 5				
6040	Req. / Place PO RTU	14JAN02	25JAN02	10
6050	Fabricate RTU	28JAN02	29MAR02	45
6060	Ship/Customs/Deliver RTU	01APR02	26APR02	20
OTHER KVAERNER SUPPLIED EQUIPMENT				
6100	Req. / Place PO Other Equipment	17DEC01	28DEC01	10
6110	Fabricate Other Equipment	31DEC01	08MAR02	50
6120	Ship/Customs/Deliver Other Equipment	11MAR02	05APR02	20
STRUCTURAL STEEL				
5465	Fabricate Pipe Rack Steel	04DEC01	14JAN02	30
5485	Deliver Pipe Rack Steel	25DEC01	21JAN02	20
5475	Fabricate Bldg Support Steel	07JAN02	15FEB02	30
5505	Deliver Bldg Support Steel	28JAN02	22FEB02	20
BRAZIL				
CONSTRUCTION				
5045	Clear Site / Grade (By Others)	15NOV01*	26DEC01	30
5075	Pipe Rack Foundations	01JAN02	24JAN02	18
5065	Chiller Foundations	08JAN02	31JAN02	18
5095	Electrical Building Foundations (3)	08JAN02	31JAN02	18
5055	CTG's 17 - 20 & Assc. Equip. Fdns.	08JAN02	18FEB02	30
5085	Transformer Foundations	22JAN02	06FEB02	12
5115	Erect Pipe Rack Steel/Building Support Steel	22JAN02	06FEB02	12
5135	Install CTG's 17 - 20	29JAN02	22APR02	60
5185	Install Chillers	01FEB02	26FEB02	18
5205	Install Transformers	07FEB02	20MAR02	30
5105	Install U/G Pipe	26FEB02	25MAR02	20
5125	Fab & Install A/G Pipe & Test	05MAR02	27MAY02	60
5155	Install Instruments	19MAR02	27MAY02	50



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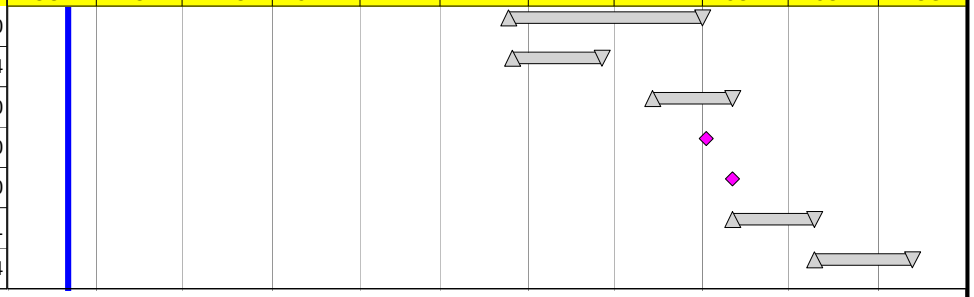
El Paso Macae Power Project
Power Block 5
Master Project Schedule

Activity ID	Activity Description	Current Early Start	Current Early Finish	Orig Dur
5145	Install Electrical	25MAR02	31MAY02	50
5195	Install Electrical Bldgs. (3)	26MAR02	26APR02	24
5165	Pre-commissiong & Commissioning	14MAY02	10JUN02	20
5235	Mechanical Completion		01JUN02*	0
5215	READY for PRODUCTION		10JUN02	0
5225	Final Completion	11JUN02	09JUL02	21
5999	De-mobilization	10JUL02	12AUG02	24



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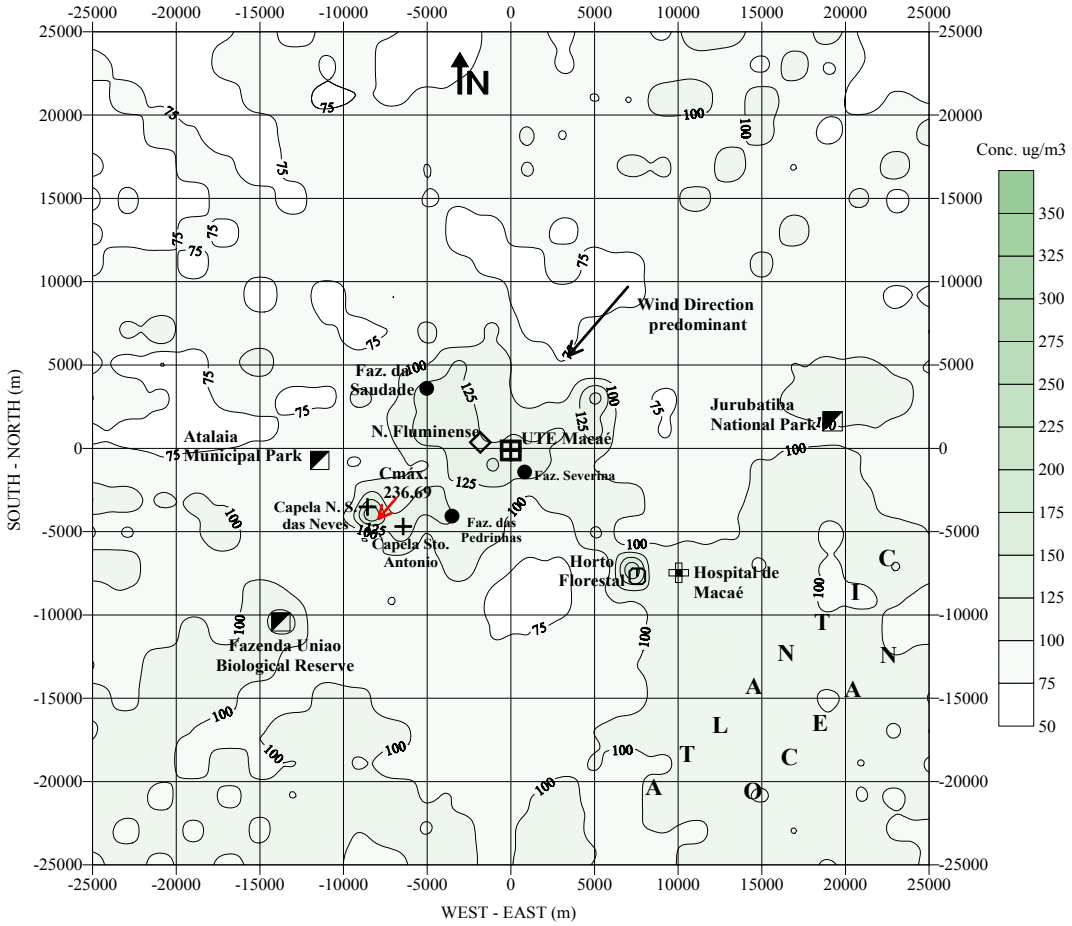
El Paso Macae Power Project
Power Block 5
Master Project Schedule

MACAÉ NOX MÉDIA HORÁRIA

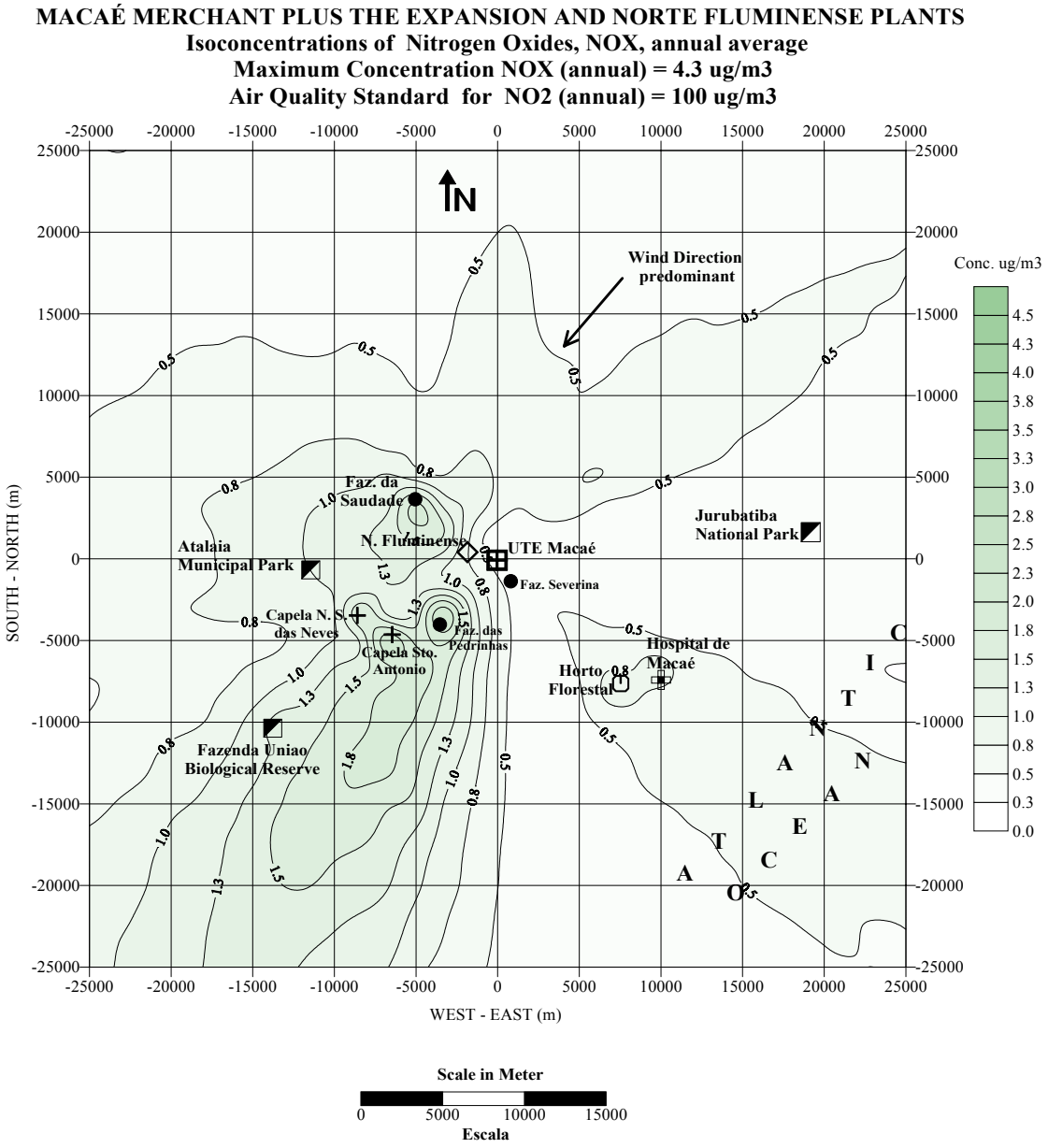
MACAÉ MERCHANT PLUS THE EXPANSION AND NORTE FLUMINENSE PLANTS
Isoconcentrations of Nitrogen Oxides, NOX, 1- hour average
Maximum Concentration NOX (1 h) = 236.69 ug/m3
Air Quality Standard for NO2 (1h) = 320 ug/m3



Scale in Meter

0 5000 10000 15000

MACAÉ NOX MÉDIA ANUAL



Simulation of the Acoustic Impact of the Norte Fluminense and El Paso Thermoelectric Plants

1. Introduction

This report presents a description and analysis of the results of a simulation of the sound pollution expected as a result of the simultaneous operation of the Norte Fluminense and Macaé Merchant El Paso Thermoelectric Plants, including their expansion, in the municipality of Macaé. This report considers the new positioning of the expansion units. The purpose of the study is to evaluate the noise caused by the 23 turbines of the two thermoelectric plants, 3 at Norte Fluminense, 16 at El Paso and 4 at the El Paso expansion. This simulation will enable a better definition of possible acoustic protection and treatment in order to minimize the environmental impact.

2. Topography

The location and topography of the site plan for the plants follow the same conditions as the last study performed for the same two thermoelectric plants, described in document TEC-NFEP-001-01 dated September 13, 2001. In order to model the ground profile, the same CAD drawing supplied by ECOLOGUS was used. The new location of the El Paso plant expansion in the modeling was determined according to the coordinates of the new plant also provided by ECOLOGUS. In sheet 1 attached the perspectives of the land modeled for the four simulated simulations are shown: Background noise (original land without modifications), Norte Fluminense thermoelectric plants, El Paso thermoelectric plant (including expansion) and the Norte Fluminense and El Paso thermoelectric plants taken together.

3. Modeling of sound sources

In the same way as the previous studies of this area, Highway BR-101 was considered as the only background noise source. This background noise was defined in the simulation based on measurements made at the area and described in document TEC-ECOL-006-02 dated November 8, 2000.

Respecting the conditions required by a healthy working environment, it was considered for the sound output emitted by the power generating units that they would be emitting a maximum of 85 dB(A) at a distance of 1 m. Based on this omission and the expected size of the various equipment units, the sound

output emitted was estimated. This level of sound output is used subsequently in the simulation program. For this estimate, it was considered that a surface sound pressure level of 85dB(A) (*Ls*) would be measured in accordance with the ISO 3746 standard. Therefore considering the dimensions of the source, the level of the sound output (*Ls*) was obtained from the formula:

$Lw = Ls + 10 \log (S/S_0)$

where *S* represents the measurement area around the source, depending on its dimensions, and $S_0 = 1.0\ m^2$ is the reference area.

The definition of the 16 original El Paso turbines took into account plans provided by ECOLOGUS at the time of the original studies in the region. For the four turbines of the expansion, identical power outputs to those of the previous study were considered, in other words the same outputs as the noisiest sources at the original El Paso plant. In the case of the Norte Fluminense turbines, the CAD drawing provided by ECOLOGUS for the previous study was considered.

Since the sources do not yet exist, issues such as directions and frequency spectrums cannot be better evaluated, nor can the effects of possible acoustic treatment, barriers or isolation be taken into account. All these variables should be considered subsequently in a more detailed simulation of the plants, including the protection measures to be adopted.

In all, 3 types of sources were simulated. At the Norte Fluminense plant, there are 3 type 1 sources, the noisiest; at the original El Paso plant, there are 12 type 2 sources and 4 type 3 sources, which are the least noisy; in the expansion of the El Paso plant, all the 4 sources were considered to be type 2. In the simulation, the value of *Lw* obtained from the following parameters was used:

1. Type 1 sources

- *Ls* = 85dB(A)
- $S = 10737.0\ m^2$
- *Lw* = 125.0 dB(A) re 1pW

2. Type 2 sources

- *Ls* = 85dB(A)
- $S = 1014.0\ m^2$
- *Lw* = 115.0 dB(A) re 1pW

3. Type 3 sources

- *Ls* = 85dB(A)
- $S = 737.6\ m^2$
- *Lw* = 113.0 dB(A) re 1pW

4. Simulation

The simulation was performed using the SoundPLAN computer program to evaluate the environmental impact of the sound pollution. The various parameters used are described below.

4.1. Simulation Parameters

The following general parameters we used to simulate the acoustic environmental impact:

- Evaluation standards:
  - traffic noise: RLS 90
  - industrial noise: VDI 2714/2720
  - air absorption: ISO 3891
- Environmental conditions:
  - atmospheric pressure: 1013 mBar
  - relative air humidity: 70%
  - temperature: 20°C
- Noise map:
  - height above ground: 1.7 m
  - spacing: 40 m

Only daytime noise was considered since the equipment will operate on a continuous basis and the traffic flow on the highway is more intense during this period. The values for the nighttime period due to operation of the plant remain unchanged.

4.2. Results

The graphic results obtained for the daily period are presented on the attached sheets, in accordance with the following list:

- Sheet 1 - Perspectives with the location of the plants
- Sheet 2 - Map of background noise
- Sheet 3 - Map of noise with the Norte Fluminense plant
- Sheet 4 - Map of noise with the El Paso plant plus expansion
- Sheet 5 - Map of noise with the Norte Fluminense and El Paso plants plus expansion
- Sheet 6 - Map of the impact of the Norte Fluminense plant
- Sheet 7 - Map of the impact of the El Paso plant plus expansion

- Sheet 8 - Map of impact with the Norte Fluminense and El Paso plants plus expansion

5. Conclusions

As observed in the previous study and as can be observed from the sheets 3 and 6 attached to this report, the Norte Fluminense plant is very noisy, causing an impact of 12dB(A) at a distance of 500 m from the turbines.

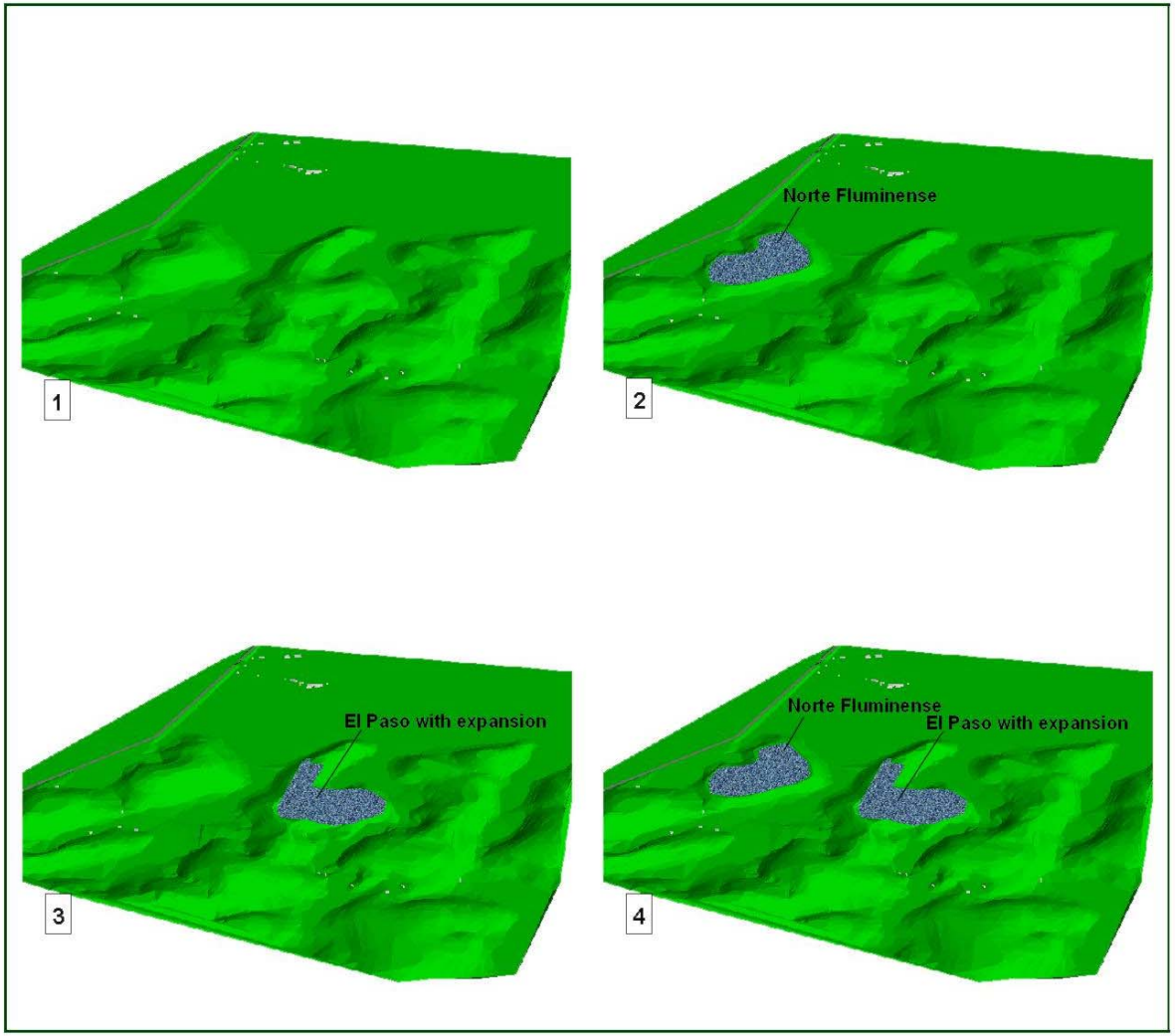
The El Paso plant, as was already observed, causes the same effect, since although it has quieter turbines, there is a larger number, compensating the lower sound output expected from the units. With the new location of the expansion, this situation is worse, since it ends up concentrating an even larger number of sound sources. On the other hand, by concentrating or the sources in the area, the local topography acts more effectively as an acoustic isolation for the plant, since at that particular site the plant is surrounded by hills - this can be seen very clearly on sheet 4. Therefore the new layout of the El Paso plant turbines can be seen to be more efficient with respect to control of the acoustic impact.

Even so, it should be noted that the hills are not sufficiently high in relation to the thermoelectric plants to satisfactory isolate the noise caused by the units. It can be seen from sheet 7 that with the operation of the El Paso plant alone (taking into account the expansion), an impact of least 12dB(A) can be expected over more than half of the region modeled. If we consider the 2 thermoelectric plants - Norte Fluminense and El Paso - operating simultaneously, this situation expands to more than two-thirds of the map, as shown on sheet 8.

Therefore it is still recommended that measures should be taken to implement some kind of acoustic treatment, reducing the level of the sound output emitted by the group of turbines to levels below those simulated in the report. Comparing with the levels indicated by the NBR 10151 standard for a rural area (40dB(A) during the day and 35dB(A) at night) as currently stipulated, the result of simulated background noise together with operation of the thermoelectric plants, shown on sheet 5, is seen to be very high. However according to the same standard, it is within the expected level for a predominantly industrial area (70dB(A) during the day and 60dB(A) at night).

Dr. Fernando Castro Pinto

CREA-RJ 88 1 0185 2D



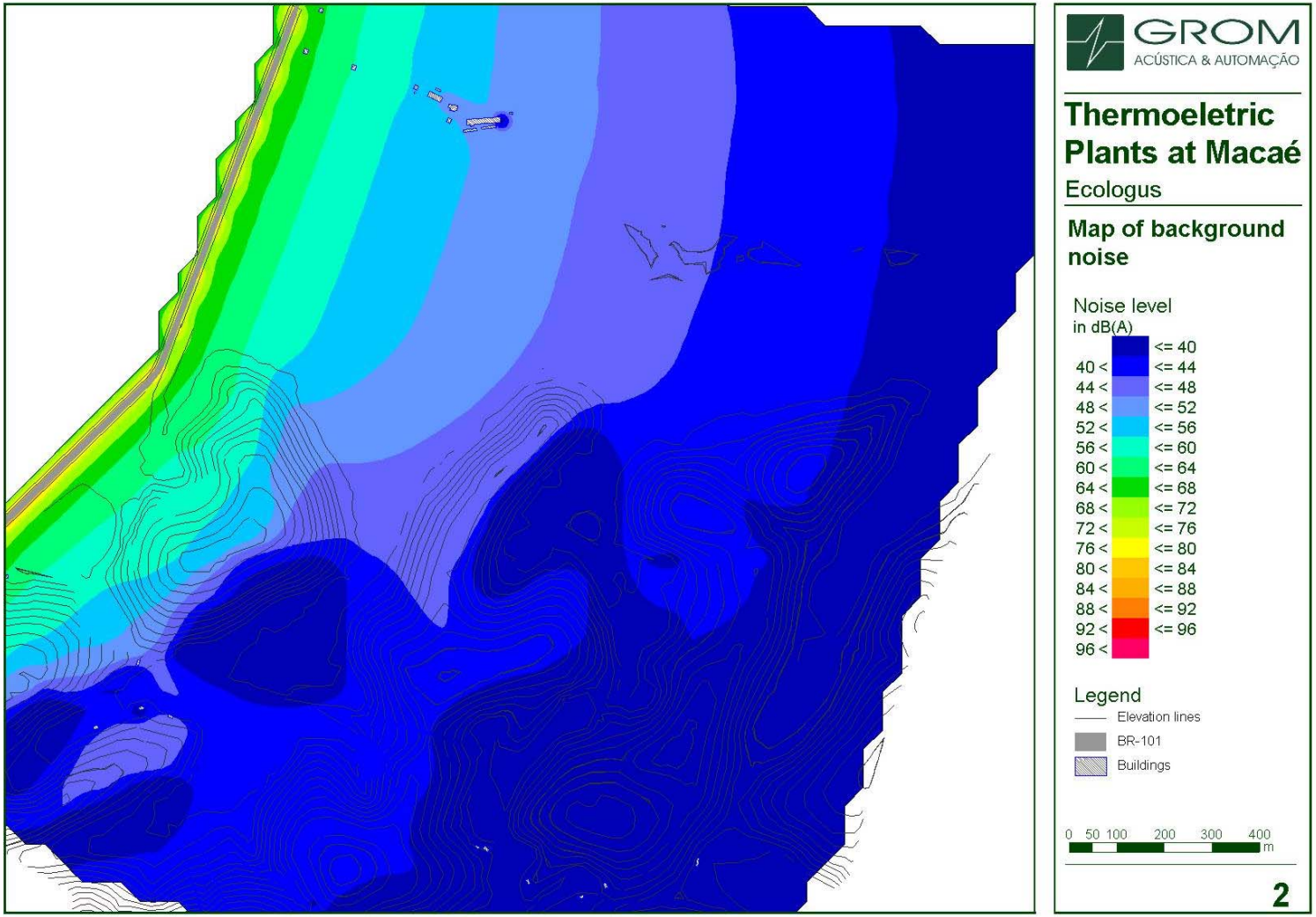
GROM
ACÚSTICA & AUTOMAÇÃO

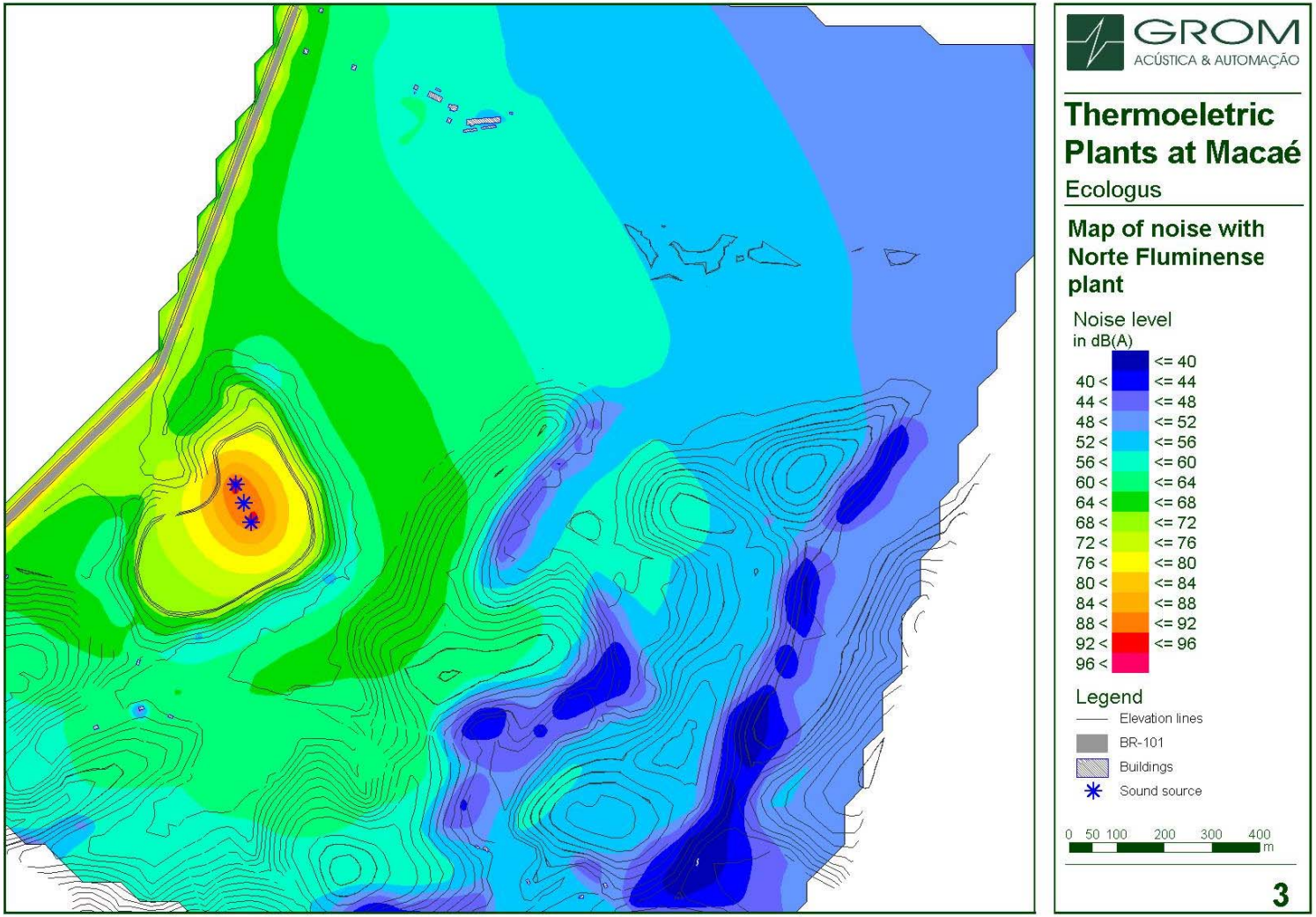
Thermoeletric Plants at Macaé

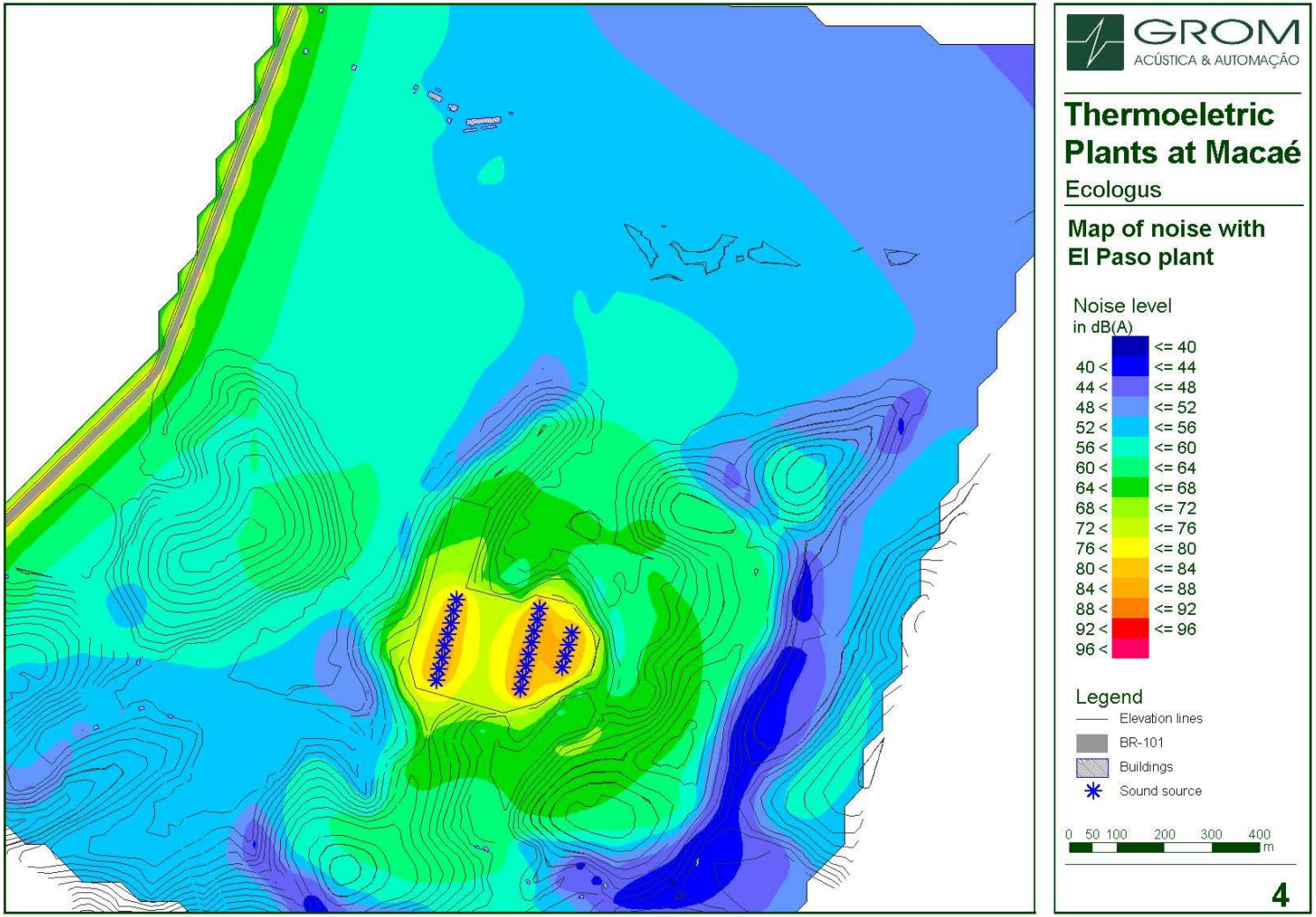
Ecologus

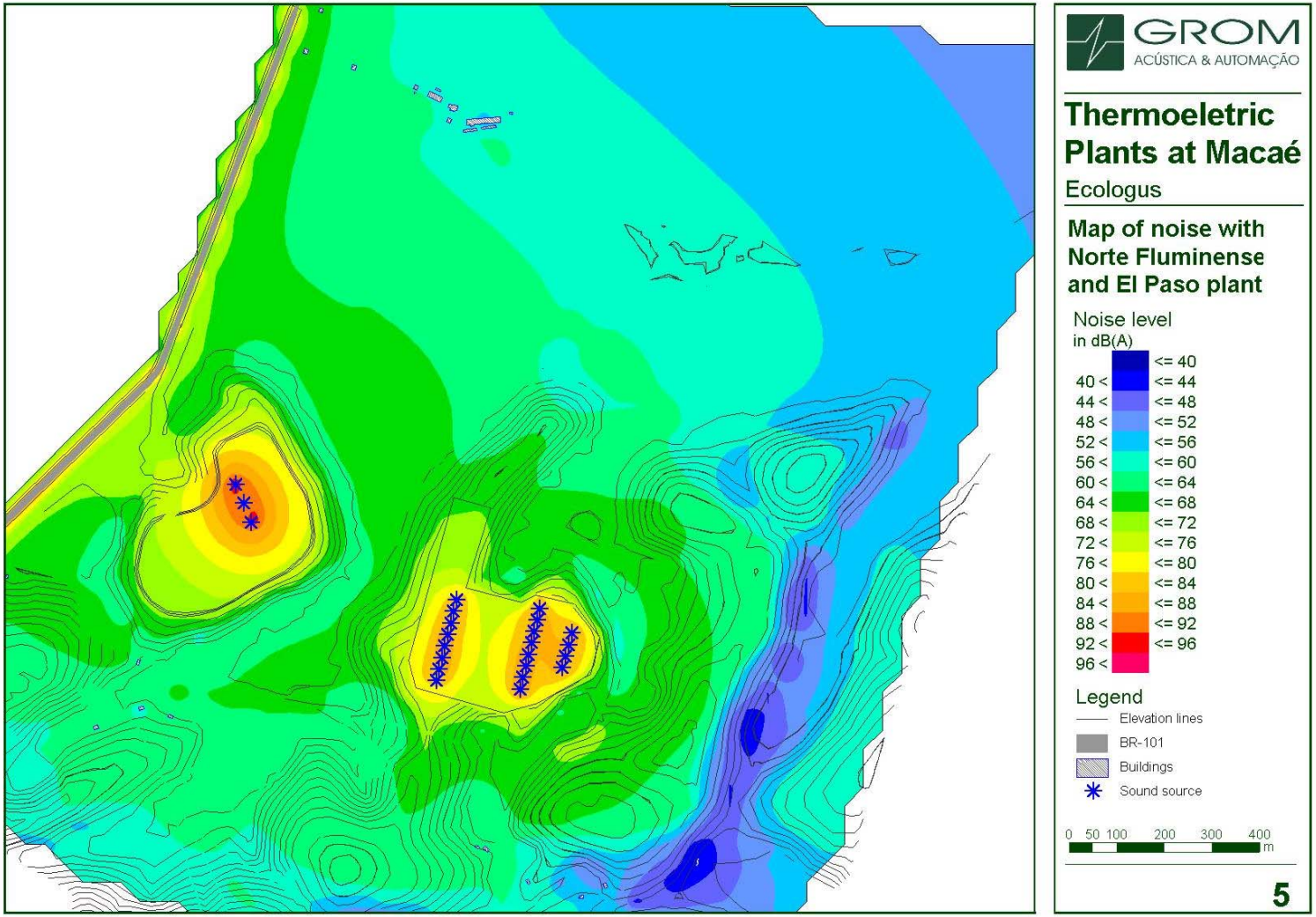
Perspectives

1 - Site without thermoelectric plants
2 - Site with only the Norte Fluminense plan
3 - Site with only the El Paso plant
4 - Site with the Norte Fluminense and El Paso plants


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of background noise
Noise level in dB(A)
<= 40
40 < <= 44
44 < <= 48
48 < <= 52
52 < <= 56
56 < <= 60
60 < <= 64
64 < <= 68
68 < <= 72
72 < <= 76
76 < <= 80
80 < <= 84
84 < <= 88
88 < <= 92
92 < <= 96
96 <
Legend
Elevation lines
BR-101
Buildings
0 50 100 200 300 400 m
2


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of noise with Norte Fluminense plant
Noise level in dB(A)
<= 40
40 < <= 44
44 < <= 48
48 < <= 52
52 < <= 56
56 < <= 60
60 < <= 64
64 < <= 68
68 < <= 72
72 < <= 76
76 < <= 80
80 < <= 84
84 < <= 88
88 < <= 92
92 < <= 96
96 <
Legend
Elevation lines
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
3


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of noise with El Paso plant
Noise level in dB(A)
<= 40
40 < <= 44
44 < <= 48
48 < <= 52
52 < <= 56
56 < <= 60
60 < <= 64
64 < <= 68
68 < <= 72
72 < <= 76
76 < <= 80
80 < <= 84
84 < <= 88
88 < <= 92
92 < <= 96
96 <
Legend
Elevation lines
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
4


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of noise with Norte Fluminense and El Paso plant
Noise level in dB(A)
<= 40
40 < <= 44
44 < <= 48
48 < <= 52
52 < <= 56
56 < <= 60
60 < <= 64
64 < <= 68
68 < <= 72
72 < <= 76
76 < <= 80
80 < <= 84
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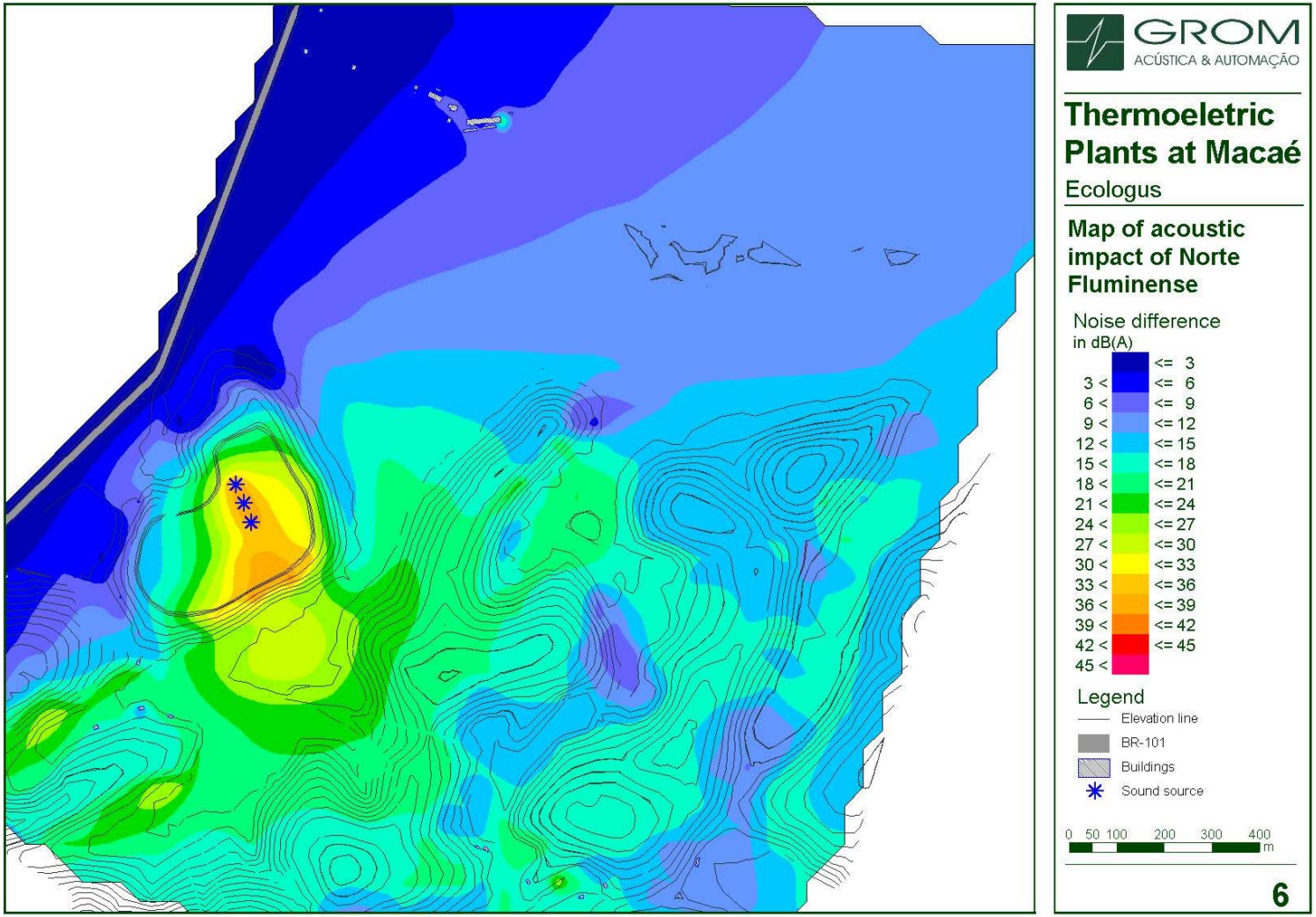
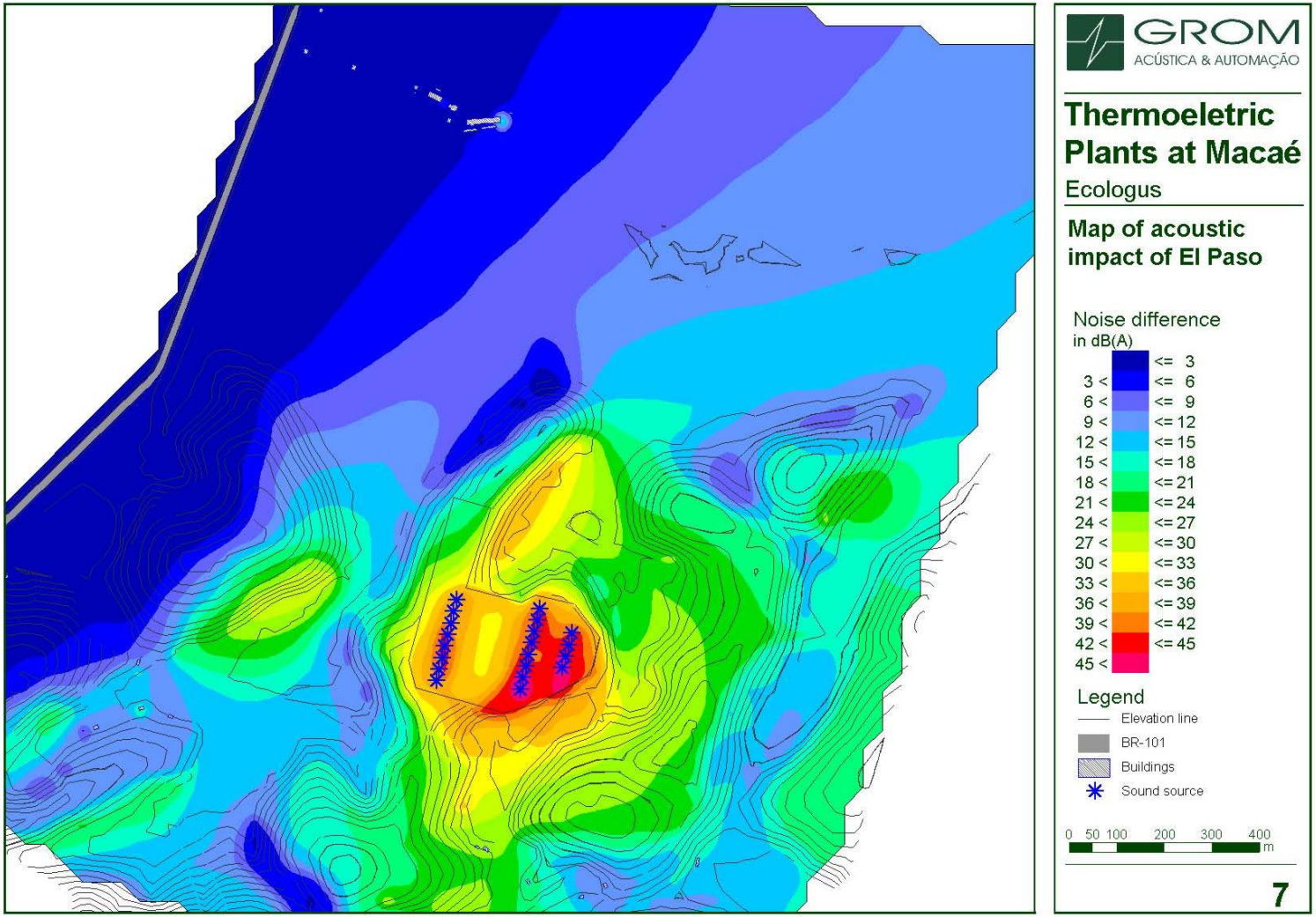
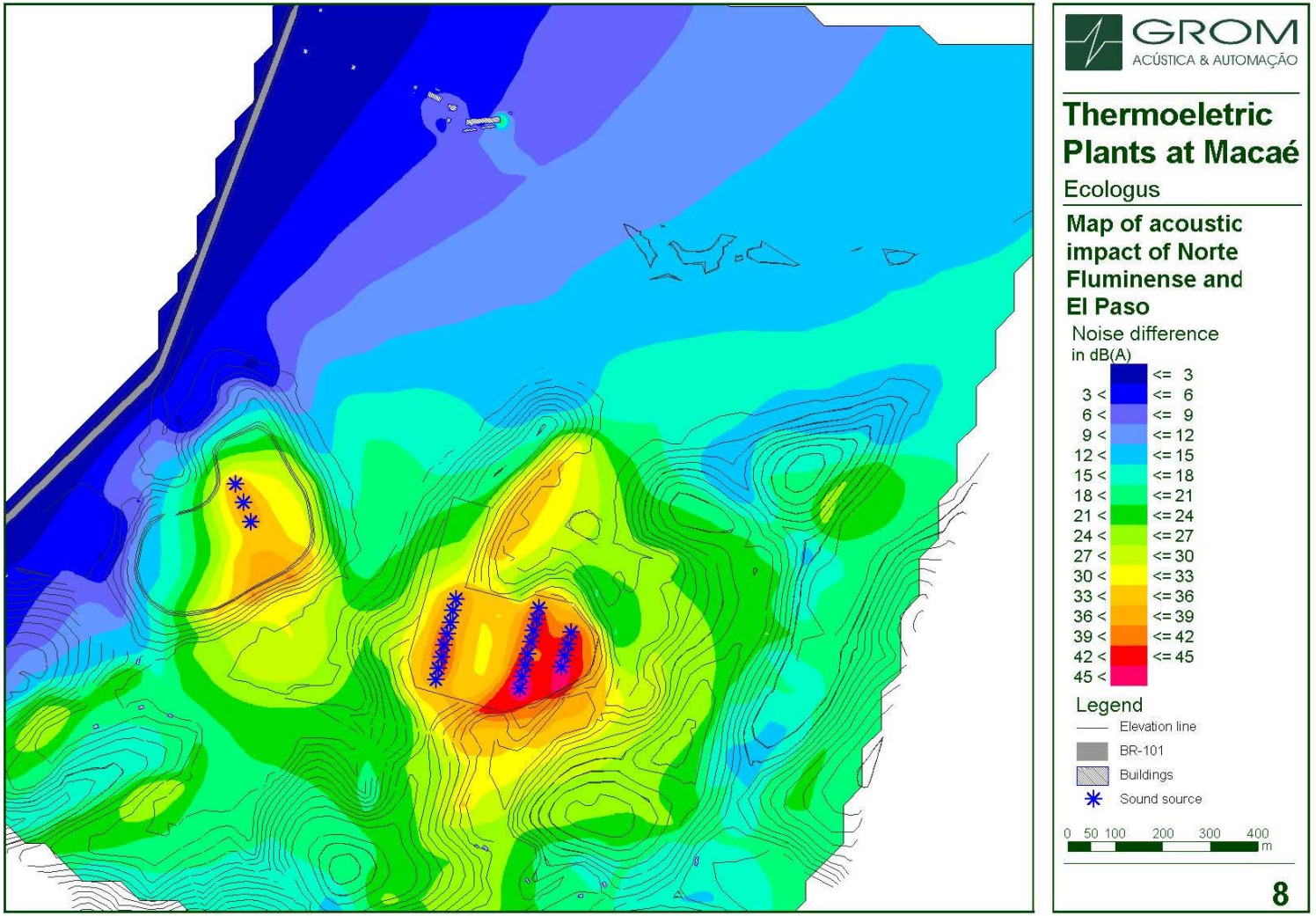
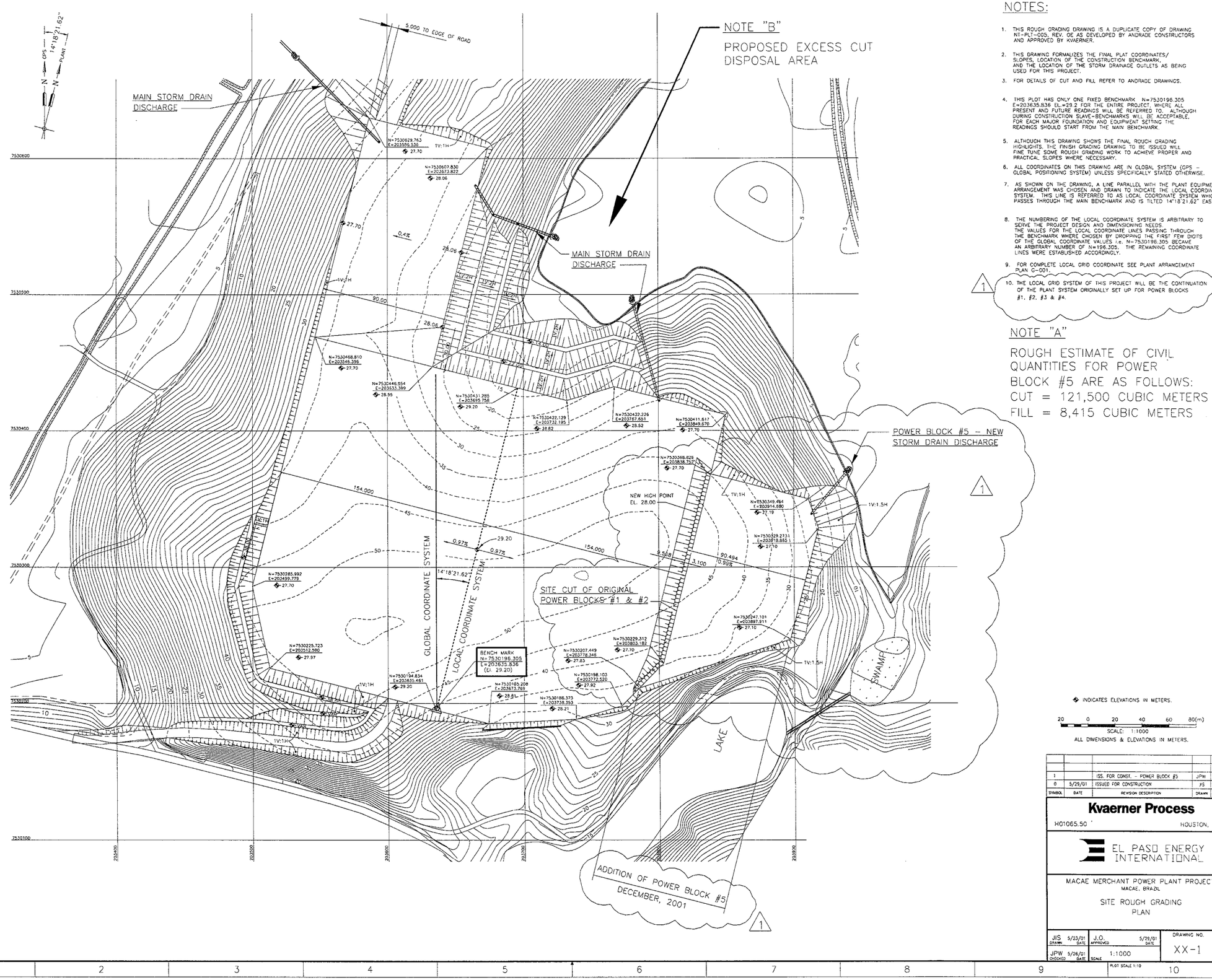
88 < <= 92
92 < <= 96
96 <
Legend
Elevation lines
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
5


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of acoustic impact of Norte Fluminense
Noise difference in dB(A)
<= 3
3 < <= 6
6 < <= 9
9 < <= 12
12 < <= 15
15 < <= 18
18 < <= 21
21 < <= 24
24 < <= 27
27 < <= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 <
Legend
Elevation line
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
6


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of acoustic impact of El Paso
Noise difference in dB(A)
<= 3
3 < <= 6
6 < <= 9
9 < <= 12
12 < <= 15
15 < <= 18
18 < <= 21
21 < <= 24
24 < <= 27
27 < <= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 <
Legend
Elevation line
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
7


GROM
ACÚSTICA & AUTOMAÇÃO
Thermoeletric Plants at Macaé
Ecologus
Map of acoustic impact of Norte Fluminense and El Paso
Noise difference in dB(A)
<= 3
3 < <= 6
6 < <= 9
9 < <= 12
12 < <= 15
15 < <= 18
18 < <= 21
21 < <= 24
24 < <= 27
27 < <= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 <
Legend
Elevation line
BR-101
Buildings
Sound source
0 50 100 200 300 400 m
8



NOTES:

1. THIS ROUGH GRADING DRAWING IS A DUPLICATE COPY OF DRAWING NT-PLT-005, REV. 0E AS DEVELOPED BY ANDRADE CONSTRUCTORS AND APPROVED BY KVAERNER.
2. THIS DRAWING FORMALIZES THE FINAL PLAT COORDINATES/ SLOPES, LOCATION OF THE CONSTRUCTION BENCHMARK, AND THE LOCATION OF THE STORM DRAINAGE OUTLETS AS BEING USED FOR THIS PROJECT.
3. FOR DETAILS OF CUT AND FILL REFER TO ANDRADE DRAWINGS.
4. THIS PLOT HAS ONLY ONE FIXED BENCHMARK. N=7530196.305 E=203635.836 EL.=29.2 FOR THE ENTIRE PROJECT, WHERE ALL PRESENT AND FUTURE READINGS WILL BE REFERRED TO. ALTHOUGH DURING CONSTRUCTION SLAVE-BENCHMARKS WILL BE ACCEPTABLE, FOR EACH MAJOR FOUNDATION AND EQUIPMENT SETTING THE READINGS SHOULD START FROM THE MAIN BENCHMARK.
5. ALTHOUGH THIS DRAWING SHOWS THE FINAL ROUGH GRADING HIGHLIGHTS, THE FINISH GRADING DRAWING TO BE ISSUED WILL FINE TUNE SOME ROUGH GRADING WORK TO ACHIEVE PROPER AND PRACTICAL SLOPES WHERE NECESSARY.
6. ALL COORDINATES ON THIS DRAWING ARE IN GLOBAL SYSTEM (GPS – GLOBAL POSITIONING SYSTEM) UNLESS SPECIFICALLY STATED OTHERWISE.
7. AS SHOWN ON THE DRAWING, A LINE PARALLEL WITH THE PLANT EQUIPMENT ARRANGEMENT WAS CHOSEN AND DRAWN TO INDICATE THE LOCAL COORDINATE SYSTEM. THIS LINE IS REFERRED TO AS LOCAL COORDINATE SYSTEM WHICH PASSES THROUGH THE MAIN BENCHMARK AND IS TILTED 14°18'21.62" EASTWARD.
8. THE NUMBERING OF THE LOCAL COORDINATE SYSTEM IS ARBITRARY TO SERVE THE PROJECT DESIGN AND DIMENSIONING NEEDS. THE VALUES FOR THE LOCAL COORDINATE LINES PASSING THROUGH THE BENCHMARK WHERE CHOSEN BY DROPPING THE FIRST TEN DIGITS OF THE GLOBAL COORDINATE VALUES i.e. N=7530196.305 BECAME AN ARBITRARY NUMBER OF N=196.305. THE REMAINING COORDINATE LINES WERE ESTABLISHED ACCORDINGLY.
9. FOR COMPLETE LOCAL GRID COORDINATE SEE PLANT ARRANGEMENT PLAN G-001.
10. THE LOCAL GRID SYSTEM OF THIS PROJECT WILL BE THE CONTINUATION OF THE PLANT SYSTEM ORIGINALLY SET UP FOR POWER BLOCKS #1, #2, #3 & #4.

NOTE "A"

ROUGH ESTIMATE OF CIVIL QUANTITIES FOR POWER BLOCK #5 ARE AS FOLLOWS:
CUT = 121,500 CUBIC METERS
FILL = 8,415 CUBIC METERS

◆ INDICATES ELEVATIONS IN METERS.

20 0 20 40 60 80(m)
SCALE: 1:1000
ALL DIMENSIONS & ELEVATIONS IN METERS.

SYMBOL	DATE	REVISION DESCRIPTION	DRAWN	APP'D
1		ISS. FOR CONST. – POWER BLOCK #5	JPW	R.C.
0	5/29/01	ISSUED FOR CONSTRUCTION	PS	R.C.

Kvaerner Process
H01065.50 HOUSTON, TEXAS

EL PASO ENERGY INTERNATIONAL

MACAE MERCHANT POWER PLANT PROJECT
MACAE, BRAZIL

SITE ROUGH GRADING PLAN

JIS 5/23/01 DRAWN DATE	J.O. 5/29/01 APPROVED DATE	DRAWING NO.	REV
JPW 5/26/01 CHECKED DATE	1:1000 SCALE	XX-1	1

PLOT SCALE 1:10

P:\H01065.50\345\POWERBLOCK5\Civil\C-FEATURE.dwg

feema

GOVERNO DO ESTADO DO RIO DE JANEIRO
SECRETARIA DE MEIO AMBIENTE E DESENVOLVIMENTO SUSTENTÁVEL
FUNDAÇÃO ESTADUAL DE ENGENHARIA DO MEIO AMBIENTE

PROCESSO Nº 202.534/01
E-07/200.640/01
RUBRICA dos FOLHA

Notificação

Nº 403.972

RAZÃO SOCIAL: EL PASO RIO CLARO LTDA
CNPJ: 02.290.787/0001-07 | INSCRIÇÃO ESTADUAL:
CÓDIGO DA EMPRESA: 10009420
UNIDADE:
CÓDIGO DA ATIVIDADE: 33.61.25
ENDEREÇO DA ATIVIDADE: RODOVIA BR-101
BAIRRO/LOCALIDADE: FAZENDA SEVERINA | R.A./DISTRITO:
MUNICÍPIO: MACAÉ | CEP:
CONTATO/REPRESENTANTE: RICARDO SALGADO MARTINS - TEL. (21) 538-4800
CARGO | TELEFONE(S) | RAMAL
TÉCNICO DA FEEMA | MATRÍCULA

Na forma do disposto na Legislação de Controle Ambiental do Estado do Rio de Janeiro, conforme Decreto nº 1.633/77, fica V.Sa notificado que quando da implantação da modificação do projeto original da UTE Macaé Merchant, sob a responsabilidade da EL PASO RIO CLARO LTDA., deverá atender às restrições em anexo, conforme processo E-07/202534/01

DIVISÃO: PRES

Rio de Janeiro, 14 de Fevereiro de 2002.

PRESIDENTE DA FEEMA — CARGO
3627430-6 — MATRÍCULA
ISAURA FRAGA

OBSERVAÇÕES

Recebi a 1a via deste documento

14/02/02 — DATA
NELSON BUSTAMANTE — GERENTE AMBIENTAL — NOME/CARGO
ASSINATURA

ATENÇÃO

1. Fazer referência ao nº deste documento em qualquer correspondência enviada à FEEMA sobre este assunto.
2. Qualquer esclarecimento sobre este documento poderá ser obtido nos seguintes endereços:
   - RIO DE JANEIRO: Rua Fonseca Teles 121 sala 1515, São Cristóvão - CEP: 20940-200 Tel. (0xx21) 3891 3336 e 3891 3337, FAX: (0xx21) 589 3283, Disque Meio Ambiente (0xx21) 589 0066/589 0919
   - CAMPOS: Rua Edmundo Chagas nº 116 - CEP 28015-080 Tel. (0xx24) 722 3644
   - FRIBURGO: Rua Alberto Rangel nº 1 Vila Nova CEP: 28630-050 Tel. (0xx24) 522 6982 - 580 0084
   - VOLTA REDONDA: AV. Almirante Adalberto Nunes nº 5.900 - Belmonte CEP: 27273-011 Tel. (0xx24) 3346 2330
   - ANGRA DOS REIS: Rua Lidia Coutinho s/nº - Pq. das Palmeiras - CEP: 23900-000 C. Bombeiros Tel. (0xx24) 3365 4165
   - ARARUAMA: Rua Bernardo de Vasconcelos S/Nº 154 Centro - CEP: 28970-000 Tel. (0xx24) 665 2567
   - PETRÓPOLIS: Rua Bingen nº 318 CEP: 25660-000 Tel. (0xx24) 242 2363

4ª via - ROSA - PROCESSO
3ª via - VERDE - U.A.
2ª via - AZUL - CECA
1ª via - BRANCA - RESPONSÁVEL

00525/23

1293

ANEXO DA NOTIFICAÇÃO Nº 403972

Restrições:

1. Operar e manter um sistema de monitoramento contínuo de emissões atmosférica para as quatro novas unidades turbogeradoras, quanto aos seguintes parâmetros: velocidade de saída, temperatura, pressão e vazão dos gases, identificado-os como O_2 , NO_X e CO, enviando os dados em tempo real para a Central de Dados de Qualidade do Ar da FEEMA;

2. Monitorar todas as quatro novas unidades turbogeradoras, sendo permitido a instalação de quatro sensores e dois monitores, isto é, um monitor para cada dois sensores, um em cada chaminé, fornecendo dados alternadamente a cada quinze minutos, de forma que todas as chaminés sejam monitoradas continuamente;

3. Instalar no prazo de 120 (cento e vinte) dias, em local a ser definido pela FEEMA, uma estação automática de monitoramento da qualidade do ar, quanto aos seguintes parâmetros: NO_X, NO, NO_2, O_3, HCT, CO, temperatura, umidade relativa, radiação solar, direção e velocidade dos ventos, enviando os dados em tempo real para a Central de Dados de Qualidade do Ar da FEEMA.

Isaura Fraga
Presidente da FEEMA

TRANSLATION

feema	GOVERNO DO ESTADO DO RIO DE JANEIRO Secretaria de Meio Ambiente e Desenvolvimento Sustentável FUNDACÃO ESTADUAL DE ENGENHARIA E MEIO AMBIENTE	Process Nr. E-07/202.534/01

Notice Nr. 403.971

Company: **EL PASO RIO CLARO LTDA**
CNPJ 02.290.787/0001-07 STATE REGISTER COMPANY: CODE: 10009420
CONTACT ACTIVITY CODE: 33.61.25
ACTIVITY ADDRESS: BR-101 Road
DISTRICT/LOCALITY: Fazenda Severina
MUNICIPALITY: Macaé
CONTACT/REPRESENTATIVE: Mr. Ricardo Salgado Martins, Phone: (21)538-4800

Pursuant to the disposal of the Environmental Control legislation of Rio de Janeiro State, according to Decree No. 1.6377/77, you are notified by this document that the modifications on the original design of Macaé Merchant TPP, owned by EL PASO RIO CLARO LTDA, was approved, in order to allow increasing the plant power and, therefore, authorizing the development of the associated works, according to process E-07/202534/01

Rio de Janeiro, February 14, 2002

First invoice received on 14/02/2002

Nelson Bustamante
Environmental Manager

ATTENTION:

1. Refer to this document number on any correspondence sent to FEEMA about this subject
2. Any explanations about this document can be obtained at the following addresses.

TRANSLATION

feema	GOVERNO DO ESTADO DO RIO DE JANEIRO Secretaria de Meio Ambiente e Desenvolvimento Sustentável FUNDACÃO ESTADUAL DE ENGENHARIA E MEIO AMBIENTE	Process Nr. E-07/202.534/01

Notice Nr. 403.792

Company: **EL PASO RIO CLARO LTDA**
CNPJ 02.290.787/0001-07 STATE REGISTER COMPANY: CODE: 10009420
CONTACT ACTIVITY CODE: 33.61.25
ACTIVITY ADDRESS: BR-101 Road
DISTRICT/LOCALITY: Fazenda Severina
MUNICIPALITY: Macaé
CONTACT/REPRESENTATIVE: Mr. Ricardo Salgado Martins, Phone: (21)538-4800

Pursuant to the disposal of the Environmental Control legislation of Rio de Janeiro State, according to Decree No. 1.6377/77, you are notified by this document that when implementing the modifications to the original design of Macaé Merchant TPP, owned by EL PASO RIO CLARO LTDA, the attached restrictions must be met, according to process E-07/202534/01

Rio de Janeiro, February 14, 2002

First invoice received on 14/02/2002

Nelson Bustamante
Environmental Manager

ATTENTION:

3. Refer to this document number on any correspondence sent to FEEMA about this subject
4. Any explanations about this document can be obtained at the following addresses.

TRANSLATION

ANNEX TO NOTICE Nr. 403972

Restrictions:

1. To operate and maintain a continuous air emission monitoring system addressed to the four new turbine-generator units, for the following parameters: flue gases speed, temperature, pressure and flow rate as O_2, NO_x and CO, forwarding these data to the Air Quality Data Center of FEEMA, on a real-time basis;

2. To monitor all four new turbine generator units, to which the installation of four sensors and two monitors are allowed, i.e., one monitor to each pair of sensors, one at each stack, providing alternate data every 15 minutes, so all stacks are continuously monitored;

3. Install an automatic air quality monitoring station in an area to be defined by FEEMA, within 120 days, addressed to the following parameters: NO_x, NO, NO_2, O_3, Total Hydrocarbons, CO, temperature, relative humidity, solar radiation, direction and speed of the winds, forwarding these data to the Air Quality Data Center of FEEMA, on a real-time basis.

Isaura Fraga
President of FEEMA