EXHIBIT W

FACILITY RETIREMENT

OAR 345-021-0010(1)(w)

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APPENDICES

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W.1 INTRODUCTION

OAR 345-021-0010(1)(w) *Information about site restoration, providing evidence to support a finding by the Council as required by OAR 345-022-0050(1).*

Response: Under OAR 345-022-0050(1), before the Energy Facility Siting Council (EFSC) will approve the proposed energy facility, it must find that the proposed energy facility site can be restored adequately to a useful, non-hazardous condition following permanent cessation of construction or operation of the facility. EFSC must also determine whether the applicant has a reasonable likelihood of obtaining a bond or letter of credit in a form and amount satisfactory to EFSC to restore the site to a useful, non-hazardous condition. This exhibit describes the expected operating life of the proposed energy facility, how it would be retired, how the site would be restored at the end of its useful life, and an estimate of the total and unit costs of restoring the site based on the Oregon Department of Energy's *First Revised Cost Guide for Decommissioning Oregon Energy Facilities*. This exhibit also provides a proposed monitoring plan for site contamination by hazardous materials.

W.2 SUMMARY

For the purposes of this Application for a Site Certificate (ASC), the useful life of the proposed energy facility is 30 years. At the end of its useful life, the proposed facility would be retired and the site restored to a useful, non-hazardous condition in accordance with the approved retirement plan and in compliance with all laws and regulations in effect at the time of retirement. The cost of site restoration is expected to be $10.4 million, expressed in 2009 dollars.

W.3 USEFUL LIFE

OAR 345-021-0010(1)(w)(A) *The estimated useful life of the proposed facility*.

Response: Portland General Electric Company (PGE) would operate the Carty Generation Station for as long as a market exists for the electrical energy that it produces. For the purpose of the ASC, the estimated useful life of the proposed facility is 30 years. When it is determined that there will be no future market for the electrical energy produced by the facility, a retirement plan will be developed that is appropriate for the intended use of the site and then-current technology and submitted to EFSC for its approval. The retirement plan would outline how the facility would be retired and the site restored to a useful, non-hazardous condition.

W.4 RETIREMENT AND SITE RESTORATION

OAR 345-021-0010(1)(w)(B) *The specific actions and tasks to restore the site to a useful, non-hazardous condition.*

Response: When the decision is made to retire the Carty Generating Station, the site would be restored to a useful, non-hazardous condition in accordance with the approved retirement plan. A useful, non-hazardous condition is a condition consistent with the applicable local comprehensive land use plan and land use regulations. The Carty Generating Station and the transmission line would be sited in areas currently zoned as industrial and for Exclusive Farm Use. Site restoration would be conducted in compliance with conditions in the approved retirement plan and in compliance with all contemporary laws and regulations in effect at the time of retirement. Site restoration would consist primarily of the dismantling and removal of most equipment and structures and restoring the site to conditions suitable for agricultural use. Transmission line tower foundations, if not being used by another energy source, would be removed to a depth of [5 feet] below grade. Water pipelines would be capped and left in place. Water supply wells, if not used by another entity, would be abandoned in accordance with applicable Oregon laws and regulations. Two years prior to the date on which PGE expects to permanently shut down the proposed Carty Generating Station, a site restoration plan would be developed and submitted to EFSC for its approval.

W.5 ESTIMATED COST OF RETIREMENT

OAR 345-021-0010(1)(w)(C) *An estimate, in current dollars, of the total and unit costs of restoring the site to a useful, non-hazardous condition.*

OAR 345-021-0010(1)(w)(D) *A discussion and justification of the methods and assumptions used to estimate site restoration costs.*

Response: The cost of site restoration would depend on the nature of the zoning regulations and the approved retirement plan. Even if site restoration involves removal of all equipment and structures from the site, the cost is not expected to exceed $10.4 million, expressed in 2009 dollars.

The $10.4 million estimate was developed following the guidelines of the Oregon Department of Energy's *First Revised Cost Guide for Decommissioning Oregon Energy Facilities.* Table W-1 provides a summary breakdown of this retirement estimate. Appendix W-1 provides the full cost estimate spreadsheet.

This cost estimate is for decommissioning the Carty Generating Station Blocks 1 and 2. Each block was assumed to be a combined cycle facility using F or G class combustion turbine technology. The total plant output was assumed to be approximately 900 megawatts. The scope of the demolition was estimated by Black & Veatch based on order-of-magnitude quantities, using historical data from similar facilities to estimate installed quantities where applicable. The cost estimate assumptions are presented below.

I. General Assumptions:

1. The existing plant site is reasonably level, with no wetlands.

2. The site has sufficient areas available to accommodate demolition activities, including but not limited to, offices, lay down, and staging areas.

3. The plant consists of two gas-fired Combustion Turbine Generators, two Heat Recovery Steam Generators (HRSGs), and two Steam Turbine Generators, supporting auxiliaries, common facilities, and equipment.

4. In general, the estimate was prepared using the existing unit rates in the spreadsheets, including quantities for Permits, Mobilization, Engineering, Project Overhead, Hazardous Materials inspections, Protection, and Load and Haul, which reflect mid-2004 pricing. Once the estimate was completed, the total value, excluding performance bond allowance, was escalated to 2009Q1 using the U.S. Gross Domestic Product Implicit Price Deflator, Chain-Weight, as published in the Oregon Department of Administrative Services' "Oregon Economic and Revenue Forecast."

5. The demolition of the field erected raw water and demineralized water storage tanks, and removal of the SCR/CO catalysts unit prices were developed based on discussions with an experienced demolition contractor.

6. The cost for waste removal is included in the provided unit pricing rates.

7. The cost estimate assumes that the power block building foundations, down to a point of 3 feet 0 inches below grade, will be removed. All piling and other deep foundations will not be demolished. The estimate assumes that all concrete will be pulverized and recycled.

8. All utilities located 3 feet below grade, including, but not limited to, circulating water pipe, duct banks, drainage, service, and make-up water, fire protection, grounding grid, and other electrical systems, will be abandoned in place and not removed. The estimate does not include preparation/preventative maintenance for utilities abandoned below grade.

9. Removal and/or disposal of existing chemicals stored on site are not included in this estimate, as they are assumed to have been used and/or removed as part of final plant operation.

10. The estimate does not include costs for Environmental Site Assessment.

11. The estimate does not include removal or remediation of hazardous materials, including but not limited to, asbestos, lead paint, PCBs, and contaminated underground plumes, as none are expected.

12. The value of scrap is not included.

13. The estimate does not include salvage of any equipment for resale or storage for resale.

14. Transmission lines and tower quantities are based on allowances determined from the plant site arrangement drawing.

15. Power block quantities for Blocks 1 and 2, including civil quantities, are based on Port Westward Unit 1. The proposed Blocks 1 and 2 common buildings, administration and control, and wastewater treatment buildings, and evaporation ponds, are based on Figure B-4 of Exhibit B.

16. The Block 1 estimate includes the following major common facilities and equipment for Blocks 1 and 2:
    - Administration and Control Building
    - Water/Wastewater Treatment Building
    - 1 - Service Water Storage Tank, 400,000 gallons
    - 1 - Demineralized Water Storage Tank, 400,000 gallons
    - 1 – Neutralization Tank – 20,000 gallons
    - Spare GSU Transformer
    - Aqueous Ammonia Tanks and containment.

17. Construction power and water are assumed to be available at the Site.

18. Any lubricating oil tanks are assumed to be empty and swabbed for residual oil to permit shearing the tank steel during the demolition process.

19. The estimate assumes that backfill materials can be obtained from the spoils pile created when the plant was constructed, or from other sources in the immediate area, and that there will be no charge for the reclaimed fill material.

20. The estimate does not include backfilling of stormwater ponds or evaporation ponds.

21. Above grade demolition will include removal of all above grade structures, and the site will be seeded, leaving it in a pre-construction condition.

II. Direct Cost Assumptions:

1. The cost estimate is based on the premise that work will be performed by a general demolition contractor on a conventional rather than an engineer, procure, and construct contract basis. Costs associated with equipment rental, demolition, and all contractor services are included in the unit pricing rates.

2. Owner's costs are not included.

Table W-1 Retirement Cost Estimate

Task Description	Allocated Dollars	Comments
Task 1 - General Conditions	$816,540	Includes permits, mobilization, engineering, project overhead, hazardous materials inspections, and protection.
Task 2 - Site Construction	$1,136,270	Includes Utility Disconnects, preliminary work, site grading, underground utility removal, and solid removal from evaporation ponds.
Task 3 - Concrete Wrecking	$446,863	Includes reinforced and non-reinforced concrete
Task 4 - Building Wrecking	$287,719	
Task 5 - Steel Wrecking	$403,361	
Task 6 - Timber Wrecking	$0	
Task 7 - Thermal Protection/Liners Wrecking	$260,870	
Task 11 - Equipment Wrecking	$270,916	
Task 15 - Mechanical Wrecking	$211,465	
Task 16 - Electrical Wrecking	$437,437	
Task 17 - Load and Haul	$2,726,000	
Overhead, Profit, Insurance.	$1,176,930	Includes overhead @ 10%, profit @ 10%, Insurance @ 3%,
Scrap Credit	$0	none included
Subcontractor	$440,000	
Bond	$63,954	
Escalation 2004 to 2009	$803,032	Factor = 0.126
Total	**$10,402,937**	

W.6 MONITORING PLAN

OAR 345-021-0010(1)(w)(E) *For facilities that might produce site contamination by hazardous materials, a proposed monitoring plan, such as periodic environmental site assessment and reporting, or an explanation why a monitoring plan is unnecessary*

Hazardous materials would be stored and used at the Carty Generating Station. Hazardous materials could include, but are not limited to, oils, batteries, solvents, chemicals used to clean piping and the HRSGs, and anhydrous ammonia. Hazardous materials would be used and stored in a manner that would minimize the chance of accidental release to the environment and be consistent with a site-specific materials management and monitoring plan that PGE will develop and implement. Hazardous wastes would be disposed of through an appropriate waste disposal service provider.

APPENDIX W-1

Detailed Cost Estimate Spreadsheet

Part 1 - Gas-Fired Combined Cycle Energy Facilities - Carty 1 & 2 - 850 MW
Unit 1 & Common Facilities (CARTY1) - 1x1 Gas-Fired Combined Cycle - 425 MW
Unit 2 (CARTY2) - 1x1 Gas-Fired Combined Cycle - 425 MW

TASK DESCRIPTION	Unit	CARTY1 Qty	Unit Cost	CARTY1 Total	CARTY2 Qty	Unit Cost	CARTY2 Total	Methods/Assumptions
1. GENERAL CONDITIONS								
A. PERMITS								
1. DEMOLITION	EA	1	$100.00	$100	1	$100.00	$100	Permit required by local jurisdiction, Estimator assumes $100/each.
2. STREET USE	EA	1	$200.00	$200	1	$200.00	$200	Permit required by local jurisdiction, Estimator assumes $200/each.
3. UTILITIES	EA	1	$200.00	$200	1	$200.00	$200	Permit required by local jurisdiction, Estimator assumes $200/each.
4. EPA ASBESTOS NOTICE	EA	1	$2,000.00	$2,000	1	$2,000.00	$2,000	Permit required by local jurisdiction, Estimator assumes $2,000/each.
1.A Subtotal				$2,500			$2,500	
B. MOBILIZATION								
1. TRUCKING ON/OFF	TR	20	$1,200.00	$24,000	18	$1,200.00	$21,600	Estimator assumes 18 wheel tractor and flat-bed trailer, 80,000 pound capacity that costs $100/hour, Method includes (4) four hours load/unload time, (8) eight hour round trip, Unit cost $1,200.00/trip.
2. SUBCONTRACTOR	EA	3	$10,000.00	$30,000	3	$10,000.00	$30,000	One time charges for subcontractor mobilizations, estimator assumes $10,000 for each mobilization for each subcontractor.
3. ON-SITE MOVES	EA	6	$200.00	$1,200	6	$200.00	$1,200	Estimator assumes 18 wheel tractor and flat-bed trailer, 80,000 pound capacity that costs $100/hour, Method includes (1) one hour load/unload time, (1) one hour movement on site, Unit cost $200.00/trip.
4. HAND TOOLS & EQUIPMENT	TR	2	$2,000.00	$4,000	2	$2,000.00	$4,000	Estimator assumes to assemble tools at contractors yard, load tools onto truck, trucking to the site, unload site tools, 20 total hours/trip at $100/hour. Another trip is required to remove tools from the site and return them to the contractors yard.
1,B Subtotal				$59,200			$56,800	
C. ENGINEERING								
1. ENGINEERING	LS	6	$5,000.00	$30,000	4	$5,000.00	$20,000	Engineering allowance for critical lift plans assumes 40 hours of engineering time at $125/hour.
2. LAYOUT / TESTING	LS	1	$12,500.00	$12,500	1	$12,500.00	$12,500	Engineering allowance for site survey of existing site conditions assumes 100 hours of engineering time at $125/hour.
3. CUSTOM TOOLS & EQUIP	LS	2	$15,000.00	$30,000	2	$15,000.00	$30,000	Custom tool allowance for critical lifts. Assumes one time charge of $15,000 to purchase special tools that are not included in Task 1.F.9. "Tools and Consumables".
1.C Subtotal				$72,500			$62,500	
D. PROJECT OVERHEAD								
1. SUPERVISION	HR	1,320	$78.00	$102,960	660	$78.00	$51,480	Site management wages /vehicle /communication tools, Assumes $70/hr fully burdened wages, $5/hr vehicle cost and $3/hr computer/cell/radio cost. (10x6x22)
2. FOREMAN	HR	1,320	$70.00	$92,400	660	$70.00	$46,200	Site supervision wages/vehicle/communication tools, Assumes $62/hr fully burden wages, $5/hr vehicle cost, $3/hr communication tools cost. (10x6x22)
3. GUARD SERVICE	WK	30	$2,000.00	$60,000	15	$2,000.00	$30,000	3rd party guard service to protect salvage items while on the ground in stockpiles while contractor prepares to load scrap into delivery trailers or containers, assumes night and weekend service at $2,000/week.
4. CLERICAL	HR	1,100	$20.00	$22,000	550	$20.00	$11,000	Office staff assistant wages and communication tools, assumes $18/hr fully burden wages and $2/hr computer cost. (10x5x22)
5. JOBSITE OFFICE	WK	4	$125.00	$500	2	$125.00	$250	Jobsite office to house temporary demolition services personnel, assumes 3rd party rental cost at $125/week. (22x2/3)
6. TEMP. UTILITIES	WK	20	$50.00	$1,000	10	$50.00	$500	Jobsite temporary utilities during decommissioning assumes cost at $50/wk.
7. SPECIAL INSURANCE	LS	1	$1,000.00	$1,000	0.5	$1,000.00	$500	Special liability insurance if required by jurisdiction in addition to normal liability coverage. Assumes lump sum of $1,000.
8. SUBSISTENCE	WK	22	$2,000.00	$44,000	11	$2,000.00	$22,000	Temporary living expenses for 7 man crew at $286/man week, assumes a 4 day work week per man.
1.D Subtotal				$323,860			$161,930	
E. HAZARDOUS MATERIALS INSPECTIONS								
1. ACM (ASBESTOS ABATEMENT)	EA	1	$20,000.00	$20,000	1	$20,000.00	$10,000	Task is the hazard material review required by local jurisdiction, cost of task based on industry experience of estimator at $20,000/each review.
2. UST (U/G STORAGE TANKS)	EA	1	$1,000.00	$1,000	0	$1,000.00	$0	Task is the hazard material review required by local jurisdiction, cost of task based on industry experience of estimator at $1,000/each review.
3. LEAD	EA	1	$2,000.00	$2,000	1	$2,000.00	$1,000	Task is the hazard material review required by local jurisdiction, cost of task based on industry experience of estimator at $2,000/each review.
1.E Subtotal				$23,000			$11,000	
F. PROTECTION								
1. SIGNS	EA	2	$200.00	$400	2	$200.00	$400	Installation, maintenance and dismantle of on site demolition signs required for local notification, estimator assume $100 material, $100 labor for each sign.
2. FENCES	LF	2,000	$2.00	$4,000	2,000	$2.00	$4,000	Installation of temporary fencing required to protect property and public, estimated unit cost of $2.00/lf is cost to rent, maintain and dismantle temporary fencing.
3. PEDESTRIAN WALKWAY	LF	0	$10.00	$0	0	$10.00	$0	The installation of temporary pedestrian protection required in high public foot traffic areas. Estimate of $10/lf includes material, installation, maintenance and dismantle costs.

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TASK DESCRIPTION	Unit	CARTY1 Qty	Unit Cost	CARTY1 Total	CARTY2 Qty	Unit Cost	CARTY2 Total	Methods/Assumptions
4. SCAFFOLDING	SF	720	$5.00	$3,600	360	$5.00	$1,800	Installation of temporary scaffolding required for personnel access where motorized manlifts are not feasible, the $5/sf estimate includes material, installation, maintenance and removal of temporary scaffolding. (2x30x3x2)
5. SHORING	SF	960	$5.00	$4,800	480	$5.00	$2,400	Temporary shoring where required by local jurisdiction and conditions. Estimated cost includes material, installation, maintenance and removal. (8x40x2 + 8x20x2)
6. OPENINGS	EA	20	$20.00	$400	10	$20.00	$200	Temporary opening coverings to protect public and demolition personnel. Estimate includes material, installation, maintenance and removal.
7. DECKING	SF	1,000	$1.00	$1,000	500	$1.00	$500	Temporary decking for work platforms. Estimate includes material, installation, maintenance and removal. (50x2)
8. FLAGGING	DY	6	$250.00	$1,500	3	$250.00	$750	Temporary flagging for movement of oversized loads or disconnects. Assumes 8 hr/dy at $31.25/hr.
9. TOOLS AND CONSUMABLES	LS	1	$10,000.00	$10,000	0.5	$10,000.00	$5,000	Tool/consumable allowance for the site. Estimators allowance of $5,000 for small crew.
1.F Subtotal				$25,700			$15,050	
Section 1 Subtotal				$506,760			$309,780	
2. SITE CONSTRUCTION								
A. UTILITY DISCONNECTS								
1. POWER	EA	0	$500.00	$0	0	$500.00	$0	Disconnect site from local utility system, Estimators allowance for utility company support cost.
2. WATER	EA	0	$300.00	$0	0	$300.00	$0	Disconnect site from local utility system, Estimators allowance for utility company support cost.
3. GAS	EA	2	$1,500.00	$3,000	0	$1,500.00	$0	Disconnect site from local utility system, Estimators allowance for utility company support cost. Disconnect gas lines from the KB pipeline.
4. SEWER	EA	0	$300.00	$0	0	$300.00	$0	Disconnect site from local utility system, Estimators allowance for utility company support cost.
2.A Subtotal				$3,000			$0	
B. PRELIMINARY WORK								
1. CUT & CAP LINES	EA	150	$500.00	$75,000	140	$500.00	$70,000	Cut and cap lines to be left in place below grade, 8 crew hours @ $35/hr plus blind flange.
2. FENCE/GATE REMOVAL	LF	6,525	$0.75	$4,894	0	$0.75	$0	Remove existing facility fencing and gates.
3. SAW CUTTING, ETC.	LF	60	$2.80	$168	0	$2.80	$0	Sawcutting at site boundary limits connecting to public roadways, assumes cutting 6" of A/C paving estimated at $0.47/inch foot.
4. RAIL SPUR DEMO	LF	0	$6.00	$0	0	$6.00	$0	Remove rails, switches and ties and place in stockpile utilizing a 300 Excavator and 1 laborer, Assumes crew production of 31 ft/hr.
5. DRAIN TANKS/SYSTEMS	LS	4	$7,000.00	$28,000	4	$7,000.00	$28,000	Prepare an existing facilities for decommissioning including shut off of systems, draining tanks, purging lines and similar activities preparing a site prior to a demolition contractor starting wrecking. Assumes a crew of 5 men one week at $35/hr/man.
6. POND/SLUDGE EXCAVATION	CY	15,068	$5.40	$81,367	15,068	$5.40	$81,367	Utilizing a 300 Excavator, 2 Laborers and 1 10cy dump truck, remove existing/remaining operating debris from ponds to stockpile. Assume a crew production of 50cy/hr. Loading and hauling of debris off-site is handled under task 17.1.
2.B Subtotal				$189,429			$179,367	
C. SITE GRADING								
1. ROADWAY REMOVAL (ASPHALT)	SY	7,069	$0.59	$4,171	7,069	$0.59	$4,171	Utilizing a 300 Excavator and 1 Laborer, remove and load into a 10 cy end dump truck existing asphalt concrete paving 6" thick, Assumes crew production rate of 300cy/day.
2. ROADWAY REMOVAL (GRAVEL)	SY	24,797	$0.44	$10,911	24,797	$0.44	$10,911	Utilizing a 300 Excavator and 1 Laborer, remove and load into 10 cy end dump truck existing gravel pavement 6" thick. Assumes crew production rate of 400 cy/day.
3. SITE PREPARATION (TOPSOIL)	SY	74,200	$2.11	$156,562	74,200	$2.11	$156,562	Utilizing a 300 Excavator and 1 Laborer, spread and grade 6" topsoil martial imported at the cost of $1.67/sy for revegitation, Assumes crew production rate of 400cy/day.
4. SEEDING	AC	12	$2,100.00	$25,200	12	$2,100.00	$25,200	Hydro-seed areas that received topsoil to establish revegitation.
5. MASS EXCAVATION ONSITE	CY	13,400	$1.80	$24,120	13,400	$1.80	$24,120	Utilizing 400 Excavator and 1 Laborer, excavate and stockpile site materials for reuse as backfill materials. Assumes crew production of 100cy/hr.
5A. MASS EXCAVATION OFFSITE	CY	0	$11.80	$0	0	$11.80	$0	Utilizing 400 Excavator and 1 Laborer excavate and load into a 10 cy truck, haul off site for $10/cy and place into a stockpile. Assumes crew production of 100cy/hour.
6. MASS BACKFILL ONSITE	CY	34,847	$3.81	$132,767	34,847	$3.81	$132,767	Utilizing a 400 Excavator, Roller/Compactor., Dozer and 1 Laborer, backfill site materials from stockpiles onsite into excavations. Assume crew production rate of 80cy/hr.
6A. MASS BACKFILL IMPORT	CY	0	$10.81	$0	0	$10.81	$0	Utilizing 400 Excavator, Roller/Compactor, Dozer and 1 Laborer, backfill with imported materials costing $7/cy into mass site excavations. Assume crew production rate of 80cy/hr.
7. POND RECLAMATION	CY	7,704	$3.70	$28,507	7,704	$3.70	$28,507	Utilizing a dozer, Compactor and 1 Laborer removal of pond embankments into to fill pond swale area and regarded area to pre-pond excavation conditions, Assumes crew production rate of 50cy/hour.
2.C Subtotal				$382,237			$382,237	
D. UNDERGROUND UTILITY REMOVAL								

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TASK DESCRIPTION	Unit	CARTY1 Qty	Unit Cost	CARTY1 Total	CARTY2 Qty	Unit Cost	CARTY2 Total	Methods/Assumptions
1. FIREWATER LINES	LF	0	$4.20	$0	0	$4.20	$0	Utilizing a 300 Excavator, Compactor and 1 Laborer remove and backfill underground fireline utilities to 3 ft below finished grade, Assume crew productivity of 400 lf/day.
2. SEWER LINES	LF	0	$5.60	$0	0	$5.60	$0	Utilizing a 300 Excavator Compactor and 1 Laborer, remove and backfill underground sewer lines to 3 foot below finished grade Assume crew production rate of 300 ft/day.
3. GAS LINES	LF	0	$4.80	$0	0	$4.80	$0	Utilizing a 300 Excavator Compactor and 1 Laborer, remove and backfill underground gas lines to 3 feet below finished grade. Assume a crew production rate of 350 ft/day.
4. ELECTRICAL DUCTBANK	LF	0	$8.40	$0	0	$8.40	$0	Utilizing a 300 Excavator, Compactor and 1 Laborer, remove and backfill ducts to 3 feet below finished grade, Assume a crew production rate of 200 ft/day.
5. MH/CB/VAULT REMOVAL	EA	0	$500.00	$0	0	$500.00	$0	Utilizing a 300 Excavator, Compactor and 1 Laborer, remove and backfill the portion of the item to 3 ft below existing grade. Assume a crew production rate of 2 hours/each item.
6. TANKS	EA	0	$500.00	$0	0	$500.00	$0	Utilizing a 300 Excavator and 1 Laborer remove approximately 10,000 gallon or smaller below grade storage tanks to stockpile. Assume crew production rate of 2 hours/each tank. Excavation and backfill tasks are included in the appropriate tasks elsewhere in the estimate.
2.D Subtotal				$0			$0	
Section 2 Subtotal				$574,666			$561,604	
3. CONCRETE WRECKING								
A. REINFORCED CONCRETE								
1. SLAB ON GRADE	CY	1,584	$4.27	$6,764	594	$4.27	$2,536	See spreadsheet for detailed quantities. Utilizing a 300 Excavator and 1 Laborer, remove and stockpile 6" thick concrete slab on grade for on-site recycling. Assume crew production of 300cy/day.
2. MINOR FOOTINGS	CY	1,194	$7.50	$8,955	1,031	$7.50	$7,733	See spreadsheet for detailed quantity. Utilizing a 400 Excavator and 1 Laborer remove and stockpile minor concrete footings for on-site concrete recycling, Assume crew production of 175cy/day.
3. MASS FOUNDATIONS	CY	7,104	$18.40	$130,714	7,104	$18.40	$130,714	See spreadsheet for detailed quantity, Utilizing a 400 Excavator/hammer, 300 Excavator and 1 Laborer break, remove and stockpile on-site concrete foundations for recycling, Assume crew production of 150cy/day.
4. SUPERSTRUCTURE	CY	0	$12.00	$0	0	$12.00	$0	Utilizing a 400 Excavator, Shear and 1 Laborer break, remove and deliver to stockpile superstructure concrete items. Assume crew production of 150 cy/day, See spreadsheet for detailed quantity.
5. WALLS	CY	264	$12.00	$3,168	264	$12.00	$3,168	Utilizing a 400 Excavator, Shear and 1 Laborer, break, remove and deliver to stockpile concrete walls. Assume a crew production rate of 150 cy/day, See spreadsheet for detailed quantity.
3.A Subtotal				$149,600			$144,150	
B. NON-REINFORCED CONCRETE/OTHER								
1. DEAD MEN	CY	0	$18.40	$0	0	$18.40	$0	Utilizing a 400 Excavator/Hammer, 300 Excavator and 1 Laborer break remove and stockpile for on-site concrete recycle. Assume crew production of 150cy/day.
2. SECURITY RAILS	LF	0	$1.11	$0	0	$1.11	$0	Utilizing a 300 Excavator and 1 Laborer break, remove and stockpile concrete security rails for on-site recycle. Assume crew production of 300cy/day.
3. CONCRETE RECYCLE	CY	10,146	$8.00	$81,168	8,993	$8.00	$71,944	Utilizing mobile on-site concrete recycle equipment, load concrete ruble from stockpile into crusher jaw, crush, sort rebar, and stockpile material for on-site backfill and metal scrap iron stockpile. Assume $8/cy for mobile plant operation.
4. PILING	EA	0	$700.00	$0	0	$700.00	$0	Assume $700 per cast in place pile.
3.B Subtotal				$81,168			$71,944	
Section 3 Subtotal				$230,768			$216,094	
4. BUILDING WRECKING								All building wrecking assumes the structure is knocked down and put into stockpile for sorting.
1. ADMINISTRATION/CONTROL	SF	13,500	$1.85	$24,975	0	$1.85	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 100 sf/hr.
2. ELECTRICAL/MCC	SF	0	$3.00	$0	0	$3.00	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 62 sf/hr.
3. WEATHER PROTECTION	SF	0	$0.50	$0	0	$0.50	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 370 sf/hr.
4. CEMS	SF	0	$2.00	$0	0	$2.00	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 93 sf/hr.
5. Gas Compressor	SF	0	$1.80	$0	0	$1.80	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 103 sf/hr.
6. Boiler Feed	SF	2,080	$1.50	$3,120	2,080	$1.50	$3,120	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 123 sf/hr.
WASTE WATER TREATMENT BUILDING	SF	20,000	$1.70	$34,000	0	$1.70	$0	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 110 sf/hr.
8. TURBINE BUILDING	SF	37,084	$3.00	$111,252	37,084	$3.00	$111,252	Utilizing a 300 Excavator and 1 Laborer, Assumes a crew production rate of 62 sf/hr.
Section 4 Subtotal				$173,347			$114,372	
5. STEEL WRECKING								All steel wrecking assumed material is knocked down and put into stockpile for sorting.
1. SUPERSTRUCTURE	TN	1,603	$45.00	$72,135	1,603	$45.00	$72,135	Utilizing a 400 Excavator/Shear and 1 Laborer assume wrecking superstructure steel a $45.00/ton, See spreadsheet for detailed quantity.
2. MISC. METALS	TN	193	$65.00	$12,545	193	$65.00	$12,545	Utilizing a 400 Excavator/Shear and 1 Laborer assume wrecking misc. metals such as small platforms, ladders and handrail at $65.00 per ton, See spreadsheet for detailed quantity.

Part 1 - Gas-Fired Combined Cycle Energy Facilities - Carty 1 & 2 - 850 MW
Unit 1 & Common Facilities (CARTY1) - 1x1 Gas-Fired Combined Cycle - 425 MW
Unit 2 (CARTY2) - 1x1 Gas-Fired Combined Cycle - 425 MW

TASK DESCRIPTION	Unit	CARTY1 Qty	Unit Cost	CARTY1 Total	CARTY2 Qty	Unit Cost	CARTY2 Total	Methods/Assumptions
3. SOFT INTERIOR	SF	63,464	$0.40	$25,386	39,164	$0.40	$15,666	Utilizing 5 Laborers and 2 Bobcat loaders wreck soft interior materials from within structures at the rate of $0.40/sf, See worksheet for detailed quantity.
4. SORT/CLEAN	TN	3,859	$25.00	$96,475	3,859	$25.00	$96,475	Utilizing a Shear, Magnet and 6 Laborers sort and clean material delivered to stockpile from other tasks and prepare the material to be loaded into scrap and debris containers, crew production assumed to be $25.00/ton. See worksheet for details.
Section 5 Subtotal				$206,541			$196,821	
6. TIMBER WRECKING								All timber wrecking assumes material is knocked down and put into stockpile for sorting.
1. SALVAGE TIMBERS	MBF	0	$100.00	$0	0	$100.00	$0	Utilizing a 300 Excavator and 1 laborer, selectively remove salvage timber from structures at an assumed unit cost of $100/mbf.
2. EQUIPMENT WRECKING	SF	0	$3.00	$0	0	$3.00	$0	Utilizing a 300 excavator and laborer production wreck timber materials and place into stockpile at an assumed unit cost of $3.00/sf.
3. FLOOR BY FLOOR	SF	0	$10.00	$0	0	$10.00	$0	Utilizing a 300 excavator and 1 laborer selective wreck timber materials and place them into stockpile assuming a unit cost of $10.00/sf,
Section 6 Subtotal				$0			$0	
7. THERMAL PROTECTION/LINERS WRECKING								
1. POND LINERS	SY	76,000	$0.81	$61,560	76,000	$0.81	$61,560	Utilizing a 300 Excavator and 3 Laborers remove pond liners and place the material into the debris stockpile. Assumes a crew production rate of 2,500 sf/hr, See spreadsheet for detailed quantity.
2. INSULATION	SF	114,792	$0.60	$68,875	114,792	$0.60	$68,875	Utilizing 1 Laborer remove insulation materials from equipment or facilities and deposit into on-site debris stockpile. Assume crew production of 466sf/day.
3. HAZARDOUS PAINT	SF	0	$15.00	$0	0	$15.00	$0	Utilizing 1 Laborer remove hazardous paint, bag, tag and deposit into onsite storage containers for removal from site. Assume crew production of 3sf/hr.
Section 7 Subtotal				$130,435			$130,435	
11. EQUIPMENT WRECKING								All equipment is assumed to be stripped of all piping, housing, insulation, electrical and other tasks provided for in this task list prior to the equipment proper being knocked down and placed into stockpile.
1. COMBUSTION TURBINE/GENERATOR	EA	1	$13,000.00	$13,000	1	$13,000.00	$13,000	Utilizing 5 Laborers and a $150/hr crane, wreck the components of the turbine/generator equipment and place them into the stockpile. Assumes a crew duration of 5 days to complete the wrecking.
2. INLET AIR EVAP COOLERS	EA	1	$2,320.00	$2,320	1	$2,320.00	$2,320	Utilizing 3 Laborers and a Shear wreck and place into stockpile, Assume crew duration of 1 day.
3. INLET AIR FOGGERS/FILTERS	EA	0	$1,160.00	$0	0	$1,160.00	$0	Utilizing 3 Laborers and a Shear wreck and place into stockpile, assumes a crew duration of 1/2 day.
4. FUEL HEATERS	EA	2	$580.00	$1,160	2	$580.00	$1,160	Utilizing 3 Laborers and a Shear wreck and place into stockpile, assumes crew duration of 1/4 day.
5. HRSG	EA	1	$40,000.00	$40,000	1	$40,000.00	$40,000	Utilizing a crew of 5 Laborers, Shear and Excavator prepare HRSG for blasting subcontractor to fall the units (See spreadsheet for subcontractor cost) After the unit is on the ground, wreck the unit and place it into stockpile assuming a crew duration of 10 days.
6. TURBINE EXHAUST STACKS	EA	1	$20,000.00	$20,000	1	$20,000.00	$20,000	Wreck stacks assuming a unit cost of $100/Ton.
7. STEAM TURBINE/GENERATOR	EA	1	$5,200.00	$5,200	1	$5,200.00	$5,200	Utilizing 5 Laborers and a $150/hr crane, wreck the components of the turbine/generator equipment and place them into the stockpile. Assumes a crew duration of 2 days to complete the wrecking.
8. WATER-COOLED SURFACE COND.	EA	1	$7,000.00	$7,000	1	$7,000.00	$7,000	Utilizing 1 Laborer and a Shear, wreck unit to stockpile. Assume a crew duration of 4 days.
9. AIR COOLED CONDENSERS	EA	0	$17,600.00	$0	0	$17,600.00	$0	Utilizing 1 Laborer and a Shear, wreck unit to stockpile. Assumes a crew duration of 10 days.
10. FEED WATER PUMPS	EA	2	$680.00	$1,360	2	$680.00	$1,360	Utilizing 5 Laborers and a $150/hr crane, wreck units to stockpile, assumes a crew duration of 1/4 day.
11. CONDENSATE PUMPS	EA	2	$500.00	$1,000	2	$500.00	$1,000	Utilizing 3 Laborers and a Carry Deck wreck units to stockpile, assumes a crew duration of 1/3 day.
12. MISC. PUMPS	EA	30	$300.00	$9,000	25	$300.00	$7,500	Utilizing 3 Laborers and a Carry Deck wreck units to stockpile assumes a crew duration of 1/4 day.
13. AIR COMPRESSORS	EA	2	$300.00	$600	2	$300.00	$600	Utilizing 3 Laborers and a Carry Deck wreck units to stockpile assumes a crew duration of 1/4 day.
14. STANDBY DIESEL/FIRE PUMP GENERATOR	EA	2	$500.00	$1,000	0	$500.00	$0	Utilizing 3 Laborers and a Carry Deck wreck units to stockpile, assumes a crew duration of 1/3 day.
15. GAS COMPRESSORS	EA	0	$500.00	$0	0	$500.00	$0	Utilizing 3 Laborers and a Carry Deck wreck units to stockpile, assumes a crew duration of 1/3 day.
16. GAS METERING STATION	EA	1	$1,160.00	$1,160	0	$1,160.00	$0	Utilizing 3 Laborers and a Shear, wreck unit to stockpile. Assumes a crew duration of 1/2 day.
17. OIL TANKS	EA	0	$775.00	$0	0	$775.00	$0	Utilizing 3 Laborers and a Shear, wreck unit to stockpile. Assumes a crew duration of 1/3 day. Assume 40 ft diameter, 16 ft tall tank
18. RAW WATER TANKS	EA	1	$5,000.00	$5,000	0	$5,000.00	$0	Assume $100/TN @ 50 tons
19. DEMIN WATER TANKS	EA	1	$5,000.00	$5,000	0	$5,000.00	$0	Assume $100/TN @ 50 tons

Part 1 - Gas-Fired Combined Cycle Energy Facilities - Carty 1 & 2 - 850 MW
Unit 1 & Common Facilities (CARTY1) - 1x1 Gas-Fired Combined Cycle - 425 MW
Unit 2 (CARTY2) - 1x1 Gas-Fired Combined Cycle - 425 MW

TASK DESCRIPTION	Unit	CARTY1 Qty	Unit Cost	CARTY1 Total	CARTY2 Qty	Unit Cost	CARTY2 Total	Methods/Assumptions
20. FRESH WATER TANKS	EA	0	$1,160.00	$0	0	$1,160.00	$0	Utilizing 3 Laborers and a Shear, wreck unit to stockpile. Assumes a crew duration of 1/2 day. Assume 40 ft diameter, 16 ft tall tank
21. CO/SCR CATALYST	CF	3,686	$8.00	$29,488	3,686	$8.00	$29,488	Assume $8.00 per CF.
Section 11 Subtotal				$142,288			$128,628	
15. MECHANICAL WRECKING								All Mechanical materials are assumed to be stripped of other materials in other tasks. This task assumes wrecking the pipe and valves only.
1. COOLING WATER PIPING	LF	4,943	$3.50	$17,301	4,943	$3.50	$17,301	Utilizing a shear, remove piping material to stockpile, Assumes crew production rate of 0.014 manhrs/lf, See spreadsheet for detailed quantity.
2. GAS PIPING	LF	1,969	$4.00	$7,876	1,969	$4.00	$7,876	Utilizing a shear, remove piping material to stockpile, Assumes crew production rate of 0.016 manhrs/lf, See spreadsheet for detailed quantity.
3. STEAM PIPING	LF	17,267	$3.50	$60,435	17,267	$3.50	$60,435	Utilizing a shear, remove piping material to stockpile, Assumes crew production rate of 0.014 manhrs/lf, See spreadsheet for detailed quantity.
4. RAW WATER PIPING	LF	2,723	$3.50	$9,531	2,723	$3.50	$9,531	Utilizing a shear, remove piping material to stockpile, Assumes crew production rate of 0.014 manhrs/lf, See spreadsheet for detailed quantity.
5. FRESH WATER PIPING	LF	3,026	$3.50	$10,591	3,026	$3.50	$10,591	Utilizing a shear, remove piping material to stockpile, Assumes crew production rate of 0.014 manhrs/lf, See spreadsheet for detailed quantity.
Section 15 Subtotal				$105,733			$105,733	
16. ELECTRICAL WRECKING								
1. TRANSFORMERS	EA	6	$1,700.00	$10,200	5	$1,700.00	$8,500	Utilizing boom truck and 4 laborers, drain systems, unhook utilities, preserve transformers for future use, Assume 5 crew hours each transformer.
2. MCC	EA	29	$680.00	$19,720	29	$680.00	$19,720	Utilizing 300 Excavator and 1 Laborer wreck motor control centers, Assume crew production of 4 hours each.
3. WIRING	LF	646,000	$0.05	$32,300	646,000	$0.05	$32,300	Utilizing a 300 Excavator and 1 laborer remove wiring from equipment/poles or within towers. Assume crew production of 3,000ft/hr.
4. SWITCH YARD	SF	566,580	$0.31	$175,640	0	$0.31	$0	Utilizing a 300 Excavator and 1 laborer wreck equipment and small structures in switch yards to stockpile, Assume crew production of 600sf/hr.
5. TOWERS	EA	96	$1,360.00	$130,560	4	$1,360.00	$5,440	Utilizing a 300 Excavator and 1 laborer wreck and stockpile electrical tower, Assume crew production of 3 hrs/each tower. See spreadsheet for assumptions
6. GROUNDING	LF	0	$0.05	$0	0	$0.05	$0	Utilizing a 300 Excavator remove grounding from underground facilities around equipment. Assume crew production rate of 3,000ft/hr.
7. TRANSMISSION LINE WIRING	MI	18	$150.00	$2,700	3	$150.00	$450	Utilizing a line truck, driver and spotter, remove and reel up transmission line wire, Assume crew production rate of 1 mile/hour.
8. BREAKER/INSULATORS/MISC.	EA	0	$5.00	$0	0	$5.00	$0	Utilizing a laborer, remove and place into stockpile 7 each/hr.
Section 16 Subtotal				$371,120			$66,410	
17. LOAD & HAUL								
1. LOAD & HAUL - DEBRIS	LD	1,342	$500.00	$671,000	1,312	$500.00	$656,000	Utilizing a 300 Excavator and 1 Laborer load debris from stockpile into 80,000 lb 12 cy side dump truck and haul debris to disposal site, Assume 2 hr truck time for each load at $95/hr.
2. DISPOSAL - DEBRIS	LD	1,342	$500.00	$671,000	1,312	$500.00	$656,000	Tipping fees required to be paid at disposal site for accepting debris hauled under task 17.1.
3. LOAD & HAUL CONC.	LD	0	$190.00	$0	0	$190.00	$0	Utilizing 12 cy side dump haul concrete to disposal site, Assume 2 hr truck time at $95/hr.
4. DISPOSAL - CONCRETE	LD	0	$75.00	$0	0	$75.00	$0	Tipping fees for the disposal of concrete for accepting concrete hauled under task 17.3.
5. SCRAP STEEL	LD	120	$300.00	$36,000	120	$300.00	$36,000	Load only scrap metal from stockpiles into containers provided by scrap metal vendors, F.O.B. Jobsite, utilizing a 300 Excavator, Assume a crew production of 2 hours per load.
Section 17 Subtotal				$1,378,000			$1,348,000	
SECTIONS 1 THROUGH 7, 11, 15, 16, 17 SUBTOTAL				$3,819,657			$3,177,877	
OVERHEAD @	10.0%			$381,966			$317,788	Home office overhead and support.
SUBTOTAL				$4,201,623			$3,495,665	
PROFIT @	10.0%			$420,162			$349,566	Contractor Fee.
SUBTOTAL				$4,621,785			$3,845,231	
INSURANCE @	3.0%			$138,654			$115,357	Industrial Insurance.
Totals Overhead, Profit, Insurance				$940,782			$782,711	
SUBTOTAL				$4,760,439			$3,960,588	
18. SCRAP CREDIT				$0			$0	See "Scrap" worksheet for quantity and cost.
TOTAL				$4,760,439			$3,960,588	
19. TOTAL SUBCONTRACT				$220,000			$220,000	See Subcontractor worksheet for list of subcontractors and tasks.
TOTAL ALL WORK				$4,980,439			$4,180,588	
BOND	1.0%			$49,804			$41,806	Performance/Payment Bond Premium.
Escalation 2004 to 2009				$625,366			$524,933	See calculation below right line 224
TOTAL ESTIMATED COST				**$5,655,610**			**$4,747,328**	
TOTAL ESTIMATED COST for Carty 1 and Carty 2							**$10,402,937**	

	2004Q4	2009Q1
GDP Implicit Price Deflator	110.7	124.6

EXHIBIT X

NOISE
OAR 345-021-0010(1)(x)

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APPENDICES

X.1 INTRODUCTION

OAR 345-021-0010(1)(x) *Information about noise generated by construction and operation of the proposed facility, providing evidence to support a finding by the Council that the proposed facility complies with Oregon Department of Environmental Quality's noise control standards in OAR 340-035-0035.*

Response:

X.2 SUMMARY

Noise sources at the proposed generating project would include the turbines and generators, the heat recovery system, the transformers, and the cooling towers. Noise levels at the two nearest residences to the proposed Carty Generating Station were predicted with the Carty Generating Station in operation. Due to the distance from the proposed station to the residential receptors, approximately 5 miles, there would be no measureable contribution to the existing ambient noise level from the operation of the proposed Carty Generating Station. These noise levels would be in compliance with noise limits as established by the State of Oregon Department of Environmental Quality (DEQ) Regulations contained in Oregon Administrative Rule (OAR) 340-035-0035. In addition, corona noise modeling of the transmission line indicates that during foul weather the maximum increase in noise resulting from the transmission line would be 5.4 A-weighted decibels (dBA), which is also in compliance with noise limits.

Construction of the proposed generating facility would involve the operation of a range of construction equipment, including trucks, earth-moving equipment, and diesel powered equipment. The estimated maximum noise contribution due to construction at a distance of 5 miles from the Site is 35 dBA. Construction activities are listed as exempt from the rules of OAR 340-035-0035(1) by OAR 340-035-0035(5).

X.3 PREDICTED NOISE LEVELS

OAR 345-021-0010(1)(x)(A) *Predicted noise levels resulting from construction and operation of the proposed facility.*

Response:

X.3.1 Construction

Noise sources during the construction of the proposed Carty Generating Station are provided in Appendix X-1, Table 7-1. Appendix X-1, Table 7-1 also presents typical maximum sound pressure levels at various distances from the construction equipment. The nearest noise sensitive receptors to the Carty Generating Station would be approximately 5 miles away; at this distance the maximum noise contribution due to construction is estimated to be approximately 35 dBA.

X.3.2 Operation

Noise sources at the proposed Carty Generating Station are provided in Appendix X-1, Table 5-1 and include equipment associated with the turbines and generators, the heat recovery system, the transformers, and the cooling towers. Noise modeling was conducted and indicated that, due to the distance from the proposed Carty Generating Station of the closest noise sensitive properties, there would be no measureable contribution to the existing ambient noise level during operation of the facility. Appendix X-1, Figure 6-1 presents the predicted noise contributions for the Carty Generating Station.

X.4 COMPLIANCE WITH APPLICABLE REGULATIONS

OAR 345-021-0010(1)(x)(B) *An analysis of the proposed facility's compliance with the applicable noise regulations in OAR 340-035-0035, including a discussion and justification of the methods and assumptions used in the analysis.*

Response: The proposed Carty Generating Station would comply with the applicable noise limits established by DEQ in OAR-340-035-0035 for new sources located on a previously unused site. A previously unused site is defined as a site that has not been used by any industrial or commercial noise source during the 20 years immediately preceding the commencement of construction of a new industrial or commercial source on that property. New sources on previously unused sites shall not increase ambient statistical noise levels, L10 or L50, by more than 10 dBA in any single hour or exceed the levels specified for new sources located on previously used sites. The facility would typically operate 24 hours each day; therefore, the nighttime noise limits for new sources located on previously used sites would apply. Night-time limits for L50, L10, and L1 are 50, 55, and 60 dBA, respectively. Noise modeling was conducted at two locations starting on November 12, 2009, and continued 24 hours a day for four days until November 16, 2009. Ambient noise at the Threemile Canyon Farms Dairy Housing was determined to be approximately 27 dBA; the lowest noise level was measured on November 13, 2009, at approximately 0:00 hours (midnight). Ambient noise at the private residence south of the Site was determined to be approximately 16 dBA; the lowest noise level was measured on November 15, 2009, at 16:02. Accordingly, the applicable noise limits are 37 dBA and 26 dBA for the two closest noise sensitive properties. The Carty Generating Station noise contribution was modeled to be zero at both monitoring locations. Therefore, the facility would be in compliance with the noise regulations. Appendix X-1, Figure 6-1 presents the projected noise levels from the operation of the proposed Carty Generating Station. Noise contributions from the station are predicted to be less than 10 dBA at a distance of approximately 1/2 mile from the Station. Morrow County's Code Enforcement Ordinance, Section 7 – Noise as a Public

Nuisance states that if a noise nuisance results from an activity allowed by a permit issued by an authority of the county, state, or federal jurisdiction, the nuisance shall be enforced under the provisions and conditions of that particular permit.

Section 5 of Appendix X-1 provides detailed information regarding the modeling methodology used to predict noise produced during operation of the Carty Generating Station. In summary, modeling of the major project sources was conducted using the CadnaA model version 3.7.124. As a conservative measure, ground absorption or atmospheric attenuation were not included in the model setup. All equipment sound data are based on available project-specific equipment data and in-house manufacturer data. Ambient sound levels were established following procedures adopted and set forth in the Sound Measurement Procedures Manual (NPCS-1). Field sheets and calibration information can be found in Appendix X-2; raw data in the form of excel spreadsheets are available upon request.

Section 7 of Appendix X-1 provides detailed information regarding the modeling methodology used to predict noise produced during construction of the proposed Carty Generating Station. In summary, the algorithm used in the model considered the construction equipment type, numbers of each type, equipment noise emission data, usage factors, and relative distances of the noise sensitive receptors to the source of the noise. As conservative measures, ground effects were ignored; and modeling did not include credits for atmospheric absorption, ground attenuation, or the noise reducing effect of the terrain.

X.5 MEASURES DESIGNED TO REDUCE NOISE

OAR 345-021-0010(1)(x)(C) *Any measures the applicant proposes to reduce noise levels or noise impacts or to address public complaints about noise from the facility.*

Response: The combustion turbine package and steam generators for each block would be located within a generation building that would provide thermal insulation and acoustical attenuation. In addition, the boiler feed, closed cycle cooling water, and condensate pump/motor assemblies would be located inside the generation building. The heat recovery steam generators would act as silencers for the turbine exhaust gases. In addition, stack silencers may be used to reduce noise levels from other stacks.

Any complaints occurring during construction would be reported to and addressed by the construction manager's office.

X.6 MEASURES TO MONITOR NOISE

OAR 345-021-0010(1)(x)(D) *Any measures the applicant proposes to monitor noise generated by operation of the facility.*

Due to the distance from the proposed station to the residential receptors and modeling results indicating zero contribution to noise at the residential receptors, Portland General Electric Company does not propose any monitoring programs for noise generated by the operation of the proposed Carty Generating Station.

APPENDIX X-1

Environmental Noise Assessment Report

ENVIRONMENTAL NOISE ASSESSMENT REPORT

Carty Generating Station

Morrow and Gilliam County, Oregon

February 2011

Prepared for:

Portland General Electric
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Portland, OR 97204

Prepared by:

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1. Introduction

Portland General Electric (PGE) proposes to construct the Carty Generating Station, a natural gas fuel combined-cycle generating plant producing up to 900 megawatts (MW) of electrical power. The station would be located on an approximately 90 acre site near the Carty Reservoir in Morrow County, Oregon. PGE would utilize the existing 500-kilovolt (kV) Boardman to Slatt transmission line and would construct a new 500-kV, 60 cycle, alternating current (AC) single circuit or double circuit transmission line to distribute power to customers from the Carty Generating Station. This report summarizes the noise impact assessment conducted for the construction and operation of the proposed station and transmission lines.

2. Sound Fundamentals

Noise is defined as any unwanted sound. Sound is defined as any pressure variation that the human ear can detect. Humans can detect a wide range of sound pressures, but only the pressure variations occurring within a particular set of frequencies are experienced as sound. However, the acuity of human hearing is not the same at all frequencies. Humans are less sensitive to low frequencies than to mid-frequencies, and so noise measurements are often adjusted (or weighted) to account for human perception and sensitivities. The unit of noise measurement is a decibel (dB). The most common weighting scale used is the A-weighted scale, which was developed to allow sound-level meters to simulate the frequency sensitivity of human hearing. Sound levels measured using this weighting are noted as dBA (A-weighted decibels). ("A" indicates that the sound has been filtered to reduce the strength of very low and very high frequency sounds, much as the human ear does). The A-weighted scale is logarithmic, so an increase of 10 dB actually represents a sound that is 10 times louder. However, humans do not perceive the 10 dBA increase as ten times louder but as only twice as loud.

The following is typical of human responses to changes in noise level:

- A 3-dBA change is the threshold of change detectable by the human ear.
- A 5-dBA change is readily noticeable.
- A 10-dBA change is perceived as a doubling (or halving) of noise level.

Table 2-1 list some typical sources and levels of noise and corresponding human responses to the noise.

Table 2-1 Decibel Level of Some Common Sounds

Sound Source	dB(A)	Perception/Response
	150	
Carrier Deck Jet Operation	140	
	130	Painfully Loud Limit
Jet Takeoff (200 feet) Discotheque	120	
Auto Horn(3 feet) Riveting Machine	110	
Jet Takeoff (2000 feet) shout (0.5 feet)	100	
N.Y. Subway Station Heavy Truck (50 feet)	90	Very Annoying Hearing Damage (8 hours, continuous exposure)
Pneumatic Drill (50 feet)	80	Annoying
Freight Train (50 feet) Freeway Traffic (50 feet)	70	Telephone Use Difficult Intrusive
Air Conditioning Unit (20 feet)	60	
Light Auto Traffic (50 feet)	50	Quiet
Living Room Bedroom	40	
Library Soft Whisper (15 feet)	30	Very Quiet
Broadcasting Studio	20	
	10	Just Audible
	0	Threshold of Hearing

Source: New York State Department of Environmental Conservation 2003

Noise sources that affect the environment can be mobile sources such as automobiles, buses, trucks, aircraft, and trains, or stationary sources such as machinery or mechanical equipment associated with industrial and manufacturing operations or building heating, ventilating, and air-conditioning systems. Sources of construction noise are both mobile sources (e.g., trucks, bulldozers, etc.) and stationary sources (e.g., compressors, pile drivers, power tools, etc.).

The sound pressure level (SPL) that humans experience typically varies from moment to moment. Therefore, various descriptors are used to evaluate sound levels over time. Some typical descriptors are defined below.

- L_{eq} is the continuous equivalent sound level. The sound energy from the fluctuating SPLs is averaged over time to create a single number to describe the mean energy, or intensity, level. The duration of the measurement would be shown as $L_{eq}(n)$. A 24-hour measurement would be shown as $L_{eq}(24)$. The L_{eq} has an advantage over other descriptors because L_{eq} values from various sound sources can be combined to determine cumulative sound levels

- L_n, is the sound pressure level exceeded for n percent of the time. In other words, for n percent of the time, the fluctuating sound pressure levels are higher than the L_n level. L_n can be obtained by analyzing a given noise by statistical means. L_{50} is the level exceeded for 50 percent of the time. It is statistically the mid-point of the noise readings. It represents the median of the fluctuating noise levels. L_{10} is the level exceeded for 10 percent of the time. For 10 percent of the time, the sound or noise has a sound pressure level above L_{10}. For the rest of the time, the sound or noise has a sound pressure level at or below L_{10}. These higher sound pressure levels are probably due to sporadic or intermittent events. L_{90} is the level exceeded for 90 percent of the time. For 90 percent of the time, the noise level is above this level. It is generally considered to be representing the background or ambient level of a noise environment.

3. Assessment Criteria

To identify any potential noise impacts, the Carty Generating Station operational sound levels were predicted for the Project area by computer modeling and then compared to applicable noises regulations or guidance.

Under the Oregon Administrative Rules (OAR) 340-035-0005(1)(b)(B), “no persons owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour, or exceed the levels specified in Table 8, as measured at an appropriate measurement point. ” Table 3-1 provides the maximum permissible levels for new industrial and commercial noise sources as outlined in Table 8 of the OAR 340-035-0005.

Table 3-1 Oregon's "Table 8 Limits": Maximum Permissible Levels for New Industrial and Commercial Noise Sources

Statistical Descriptor	Daytime (7 a.m. – 10 p.m.) (dBA)	Nighttime (10 p.m. – 7 a.m.) (dBA)
L_{50}	55	50
L_{10}	60	55
L_1	75	60

Source: OAR 340-035-0035

4. Existing Ambient Noise

Ambient baseline, or background, sound levels are a function of such things as local traffic, farm machinery, barking dogs, birds, insects, lawnmowers, children playing, and the interaction of the wind with ground cover, buildings, trees, shrubs, power lines, etc. The sound levels vary with time of day, wind speed and direction, and the level of human activity.

Generating Station Ambient Noise Levels

A background sound level survey was conducted to determine what minimum environmental sound levels are consistently present at the potentially sensitive receptors near the proposed Carty Generating Station. Continuous sound levels were measured statistically in consecutive 10-minute intervals at two locations in the area. The locations selected are the nearest residential areas to the proposed Carty Generating Station and included the Threemile Canyon Farms Dairy Housing located west of the Columbia River Dairy, approximately 5.2 miles northwest of the Site and a private residence located at 68280 Immigrant Lane, approximately 4.9 miles south of the Site.

The Threemile Canyon Farms Dairy Housing is located approximately ¼ mile from the Columbia River Dairy. The residence is one of six residences in the immediate vicinity (within approximately a 700-foot radius). The houses are surrounded by crop irrigation circles and are located on a graveled dirt road in the heart of an active agricultural facility. Sources of ambient noise are assumed to be residential noises, including barking dogs, traffic on the dirt road and driveways surrounding the residence, farm equipment; and weather induced noises. Peak ambient noise levels generally occurred at 7:00 and between 15:00 and 16:00 each day, and minimum ambient noise levels generally occurred between 22:00 and 1:00. Figure 4-2 provides a graph of the ambient noise measurements.

The private residence at 68280 Immigrant Lane is adjacent to the Nature Conservancy's Boardman Grasslands to the north and surrounded by farm land in all other directions. The next closest residence appears to be approximately 1.25 miles to the west. The residence is located on a graveled dirt road and there is farm equipment onsite. Sources of ambient noise are assumed to be very light traffic on the gravel road, weather induced noises, and residential noises. Ambient noise at this residence is far less cyclical than at the Threemile Farms Dairy Housing, with peaks and lows not occurring in any sort of pattern. Figure 4-3 provides a graph of the ambient noise measurements.

The location of the noise measurement stations can be seen in Photographs 4-1 and 4-2 and in Figure 4-1.   The lowest hourly average L_{50} sound level measured at the Threemile Canyon Farms Dairy Housing was 27 dBA from midnight to 1 a.m. on November 13, 2009 and 16 dBA from 4 p.m. to 5 p.m. on November 15, 2009 at the private residence south of the proposed station. Therefore the maximum permissible levels shown in Table 3-1 are reduced to 37 dBA and 26 dBA (existing minimum plus 10 dBA) for the Threemile Canyon Farms Dairy Housing and the private residence, respectively.

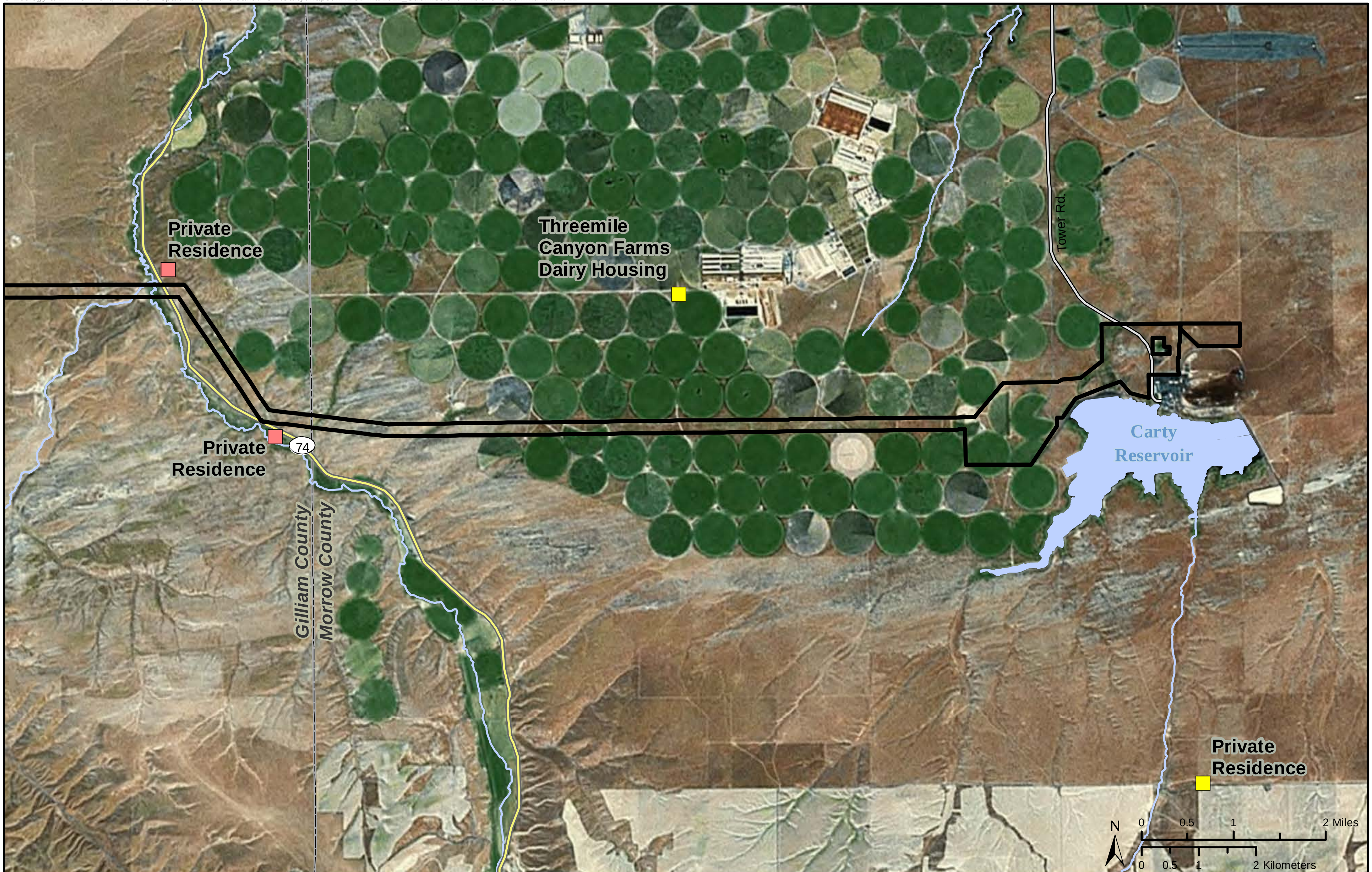
Photograph 4-1 Threemile Canyon Farms Dairy Housing Receptor Location looking east.

Photograph 4-2 Private Residence South of Proposed Carty Generating Station Site, looking southeast.

Two Rion NL series type 1 integrating sound level meters were used to carry out the survey. Each of these instruments is intended for use as a long-term environmental sound level data logging instrument measuring the A-weighted sound level. All of the meters were set to continuously record a number of statistical parameters in consecutive 10-minute intervals, including the average L_{eq}, L_{max}, L_{min}, L_{10}, L_{50}, and L_{90} sound levels. The survey period began on November 12, 2009, and continued 24 hours a day for 4 days, until November 16, 2009.

The microphones were protected from rain and self-induced wind noise by high-density foam windscreens designed for long-term outdoor service. In order to further minimize self-induced wind noise, all microphones were located at approximately 1 meter above local grade. Wind speed is a function of elevation and rapidly diminishes near the ground.

The Boardman Power Plant which has 1 boiler and 1 turbine was at constant, full load during this survey period except for the time period of about 8 a.m. to 12:30 p.m. on November 13 when the load was reduced to half for turbine valve tests; the boiler and turbine then went back to full load. No abnormal operation or event was noted by the plant operators during the survey period.



Site Boundary

Noise Monitoirng Location

15 minute Monitoring

3 day Monitoring

Figure 4-1
Morrow and Gilliam County
Ambient Noise Monitoring Locations
PGE Carty Generating Station
Application for Site Certificate

Final 2011

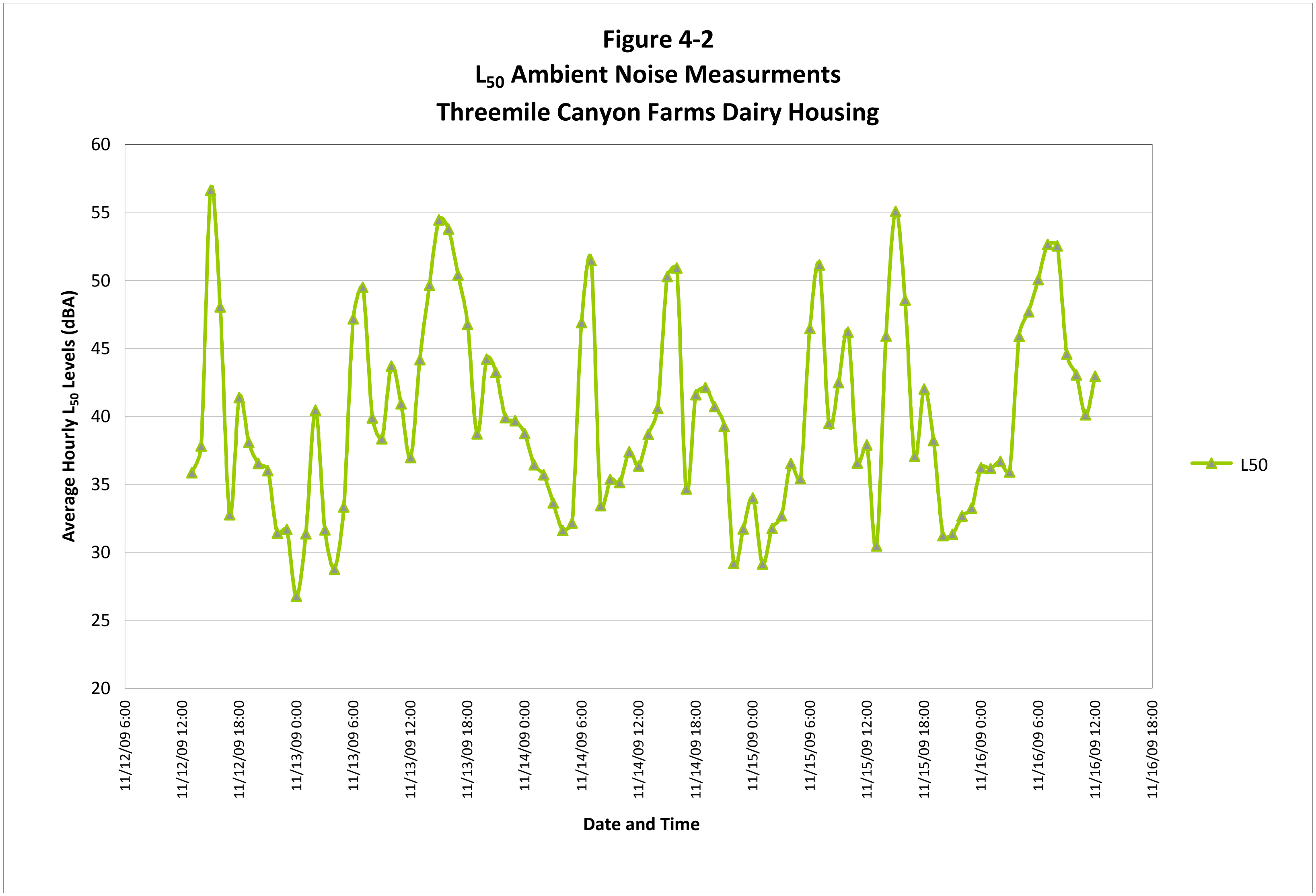


Figure 4-2
L50 Ambient Noise Measurments
Threemile Canyon Farms Dairy Housing
Average Hourly L50 Levels (dBA)
60
55
50
45
40
35
30
25
20
11/12/09 6:00
11/12/09 12:00
11/12/09 18:00
11/13/09 0:00
11/13/09 6:00
11/13/09 12:00
11/13/09 18:00
11/14/09 0:00
11/14/09 6:00
11/14/09 12:00
11/14/09 18:00
11/15/09 0:00
11/15/09 6:00
11/15/09 12:00
11/15/09 18:00
11/16/09 0:00
11/16/09 6:00
11/16/09 12:00
11/16/09 18:00
Date and Time
L50

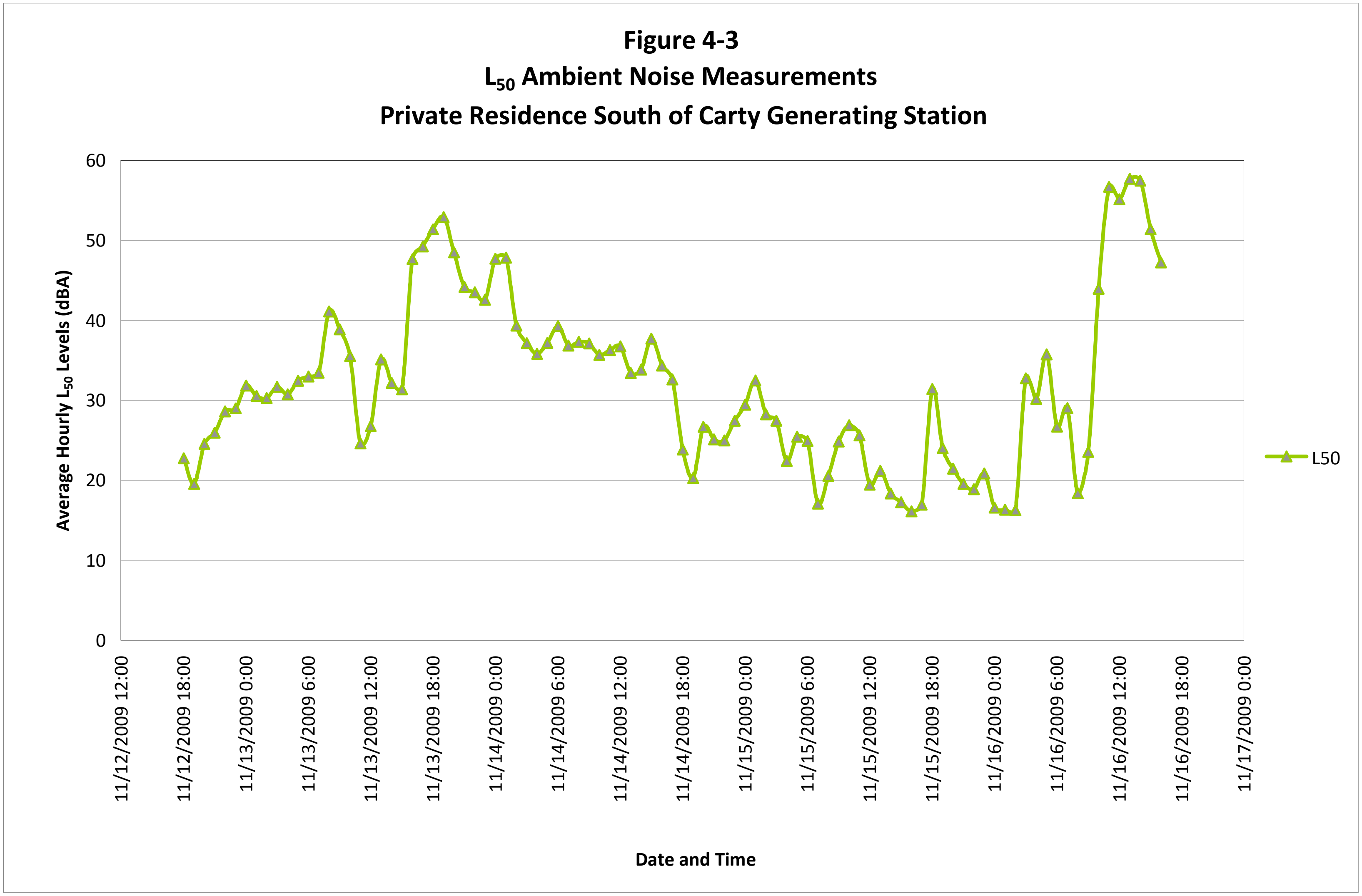


Figure 4-3
L50 Ambient Noise Measurements
Private Residence South of Carty Generating Station
Average Hourly L50 Levels (dBA)
0
10
20
30
40
50
60
11/12/2009 12:00
11/12/2009 18:00
11/13/2009 0:00
11/13/2009 6:00
11/13/2009 12:00
11/13/2009 18:00
11/14/2009 0:00
11/14/2009 6:00
11/14/2009 12:00
11/14/2009 18:00
11/15/2009 0:00
11/15/2009 6:00
11/15/2009 12:00
11/15/2009 18:00
11/16/2009 0:00
11/16/2009 6:00
11/16/2009 12:00
11/16/2009 18:00
11/17/2009 0:00
Date and Time
L50

Weather Conditions

The weather conditions during the survey period were generally clear with light winds. However, wind speeds up to 14 mph occurred during the survey period. The general weather data for temperature, wind speed, and precipitation for the survey period are presented in Table 4-1. The weather data were collected at the Willow Creek, Gilliam County Weather Station, which is located approximately 11 miles northwest of the Site.

Table 4-1 General Weather Summary for the Survey Period

	Temperature (ºF)				Wind (mph)		
Date	Max.	Min.	Avg.	Precip. (In.)	Max.	Min.	Avg.
11/12/09	46	26	36	0	6	0	3
11/13/09	45	26	35	.02	14	0	5
11/14/09	48	31	38	0	8	3	5
11/15/09	51	32	43	0	3	0	1
11/16/09	57	32	41	0	4	0	1

Transmission Line Ambient Noise Levels

To establish ambient noise levels at residential receptors nearest the transmission line, 15 minute noise measurements were taken at two private residences located closest to the existing 500-kV Boardman to Slatt transmission line. A-weighted and one-third octave band sound levels were measured on November 12, 2009 at approximately 5 feet above grade using a B & K Model 2260 Observer, an ANSI Type I sound analyzer with one-third octave band filter capability and a type 4189 microphone. The analyzer was tripod-mounted and equipped with a windscreen to eliminate noise associated with wind blowing across the microphone. Noise measurements were taken only when wind speeds were less than 12 miles per hour. The analyzer and microphone were factory-calibrated and field-calibrated with a Bruel & Kjaer Model 4231 sound-level calibrator before and after each series of measurements. Measurements were collected for approximately 15-minute periods.

Noise measurements were taken near a residence at 73280 Route 74 (Heppner Highway) and near a residence at 74475 Route 74 (See Figure 4-1). The noise measurement data collected at these two locations are presented in Table 4-2. During the measurement period, light traffic was observed along Route 74.

Table 4-2 Ambient Noise Measurements

Receptor Location	Distance to Transmission Line (feet)	L_{eq} (dBA)
73280 Route 74	780	52
74475 Route 74	1400	46

Transmission Line Corona Noise

Power generated at the Carty Generating Station would be distributed to customers by one of several options or cases. Table 4-3 presents the various cases proposed for the transmission of power. In all cases, the existing 500-kV Boardman to Slatt transmission line would be utilized while in some cases, additional lines are included. The existing 500-kV transmission line extends from the Boardman Plant to the Slatt Substation, a distance of approximately 17.8 miles.

Table 4-3 Transmission Lines Cases 1 through 4 and Case 6

Option/Case	Description
1	Existing Boardman to Slatt line carries all of Boardman generation (existing conditions).
2	Existing Boardman to Slatt with the addition of a single circuit generation lead from Carty Block 1 to a new switchyard. The existing line will connect into a new switchyard with the new line from Carty Block 1 and will carry all of the Boardman Plant and Carty Block 1 generation.
3	Existing Boardman to Slatt single circuit with the addition of a new single circuit line that runs parallel with the existing Boardman to Slatt line and a new single circuit generation lead from Carty Block 1 to a new switchyard.
4	Existing Boardman to Slatt single circuit with the addition of a new single circuit line that runs parallel with the existing Boardman to Slatt line and a two new single circuit generation leads from Carty Blocks 1 & 2 to a new switchyard.
6	Existing Boardman to Slatt single circuit with the addition of a new double circuit line that runs parallel with the existing Boardman to Slatt line and two new single circuit generation leads from Carty Blocks 1 & 2 to a new switchyard.

Corona is a partial electrical breakdown that results in the transformation of energy into very small amounts of light, sound, radio noise, chemical reaction, and heat. The audible noise generated by corona is generally characterized as a crackling, hissing, or humming noise. The greatest amount of corona noise is produced during wet or foul weather conditions. Computer modeling was performed in order to predict corona noise levels that would be experienced at the receptors for the various transmission cases. The commercially available CadnaA model developed by Datakustik GmbH was used for the analysis. Sound power for each case was calculated using the noise level referenced in the B. BPA Corona & Field Effects Program Tabular Results contained in Exhibit AA at the at the approximate center of the configuration for the ROW EMF Cut @ Slatt Sub (Looking SW) and the average line height provided in Exhibit AA. The CadnaA software takes into account spreading losses, and ground and atmospheric effects. The software is standard based and the ISO 9613 standard was used for air absorption and other noise propagation calculations.

Table 4-4 presents the estimated corona noise at the nearest residential receptors for both fair and foul weather conditions. As presented in the table, under fair weather conditions, the L50 corona noise contribution would range from 15.7 to 21.1 dBA at 73280 Route 74 and from 12.7 to 18 dBA at 74475 Route 74 for the five options (cases). Under foul weather conditions, the L50 corona noise contribution would range from 40.7 to 46.1 dBA at 73280 Route 74 and from 37.7 to 43.0 dBA at 74475 Route 74 for the five options. As indicated in the table, the increase in L50 corona noise would range from 0.0 to 5.4 dBA at 73280 Route 74 and from 0.0 to 5.3 dBA at 74475 Route 74 depending on which option is chosen.

Based on these levels, the corona noise would not exceed the Maximum Permissible Levels for New Industrial and Commercial Noise Sources (L50 of 50 dBA evening) in Table 8 of OAR 340-035-0005 nor increase the ambient statistical noise levels L50, by more than 10 dBA in any one hour during fair or foul weather conditions at the nearest residences.

Table 4-4 Estimated L50 Corona Noise Levels at the Nearest Residences

			L50 Sound Levels in dBA at Receptor		Increase Over Existing L50 in dBA	
Receptor Location	Option/Case Number	Distance to Receptor (feet)	Corona Noise Fair Weather	Corona Noise Rain	Corona Noise Fair Weather	Corona Noise Rain
73280 Route 74						
	1*	780	15.7	40.7	---	---
	2	780	15.7	40.7	0.0	0.0
	3	780	19.1	44.1	3.4	3.4
	4	780	19.1	44.1	3.4	3.4
	6	780	21.1	46.1	5.4	5.4
74475 Route 74						
	1*	1400	12.7	37.7	---	---
	2	1400	12.7	37.7	0.0	0.0
	3	1400	16.0	41.0	3.3	3.3
	4	1400	16.0	41.0	3.3	3.3
	6	1400	18.0	43.0	5.3	5.3
*Case 1 represents the existing transmission line corona noise						

5. Modeling Methodology

To identify potential noise impacts resulting from the operation of the proposed generating station, noise modeling was conducted and the modeling results were compared with OAR 340-035-0005.

Computer noise modeling of the major project sources was conducted using the CadnaA Model version 3.7.124 developed by Datakustik GmbH. Primary noise producing equipment and corresponding estimated noise emission data were provided by Black and Veatch, Inc. The model simulates the outdoor three-dimensional propagation of sound from each noise source and accounts for sound wave divergence, atmospheric and ground sound absorption, and sound attenuation due to interceding barriers and topography based on the International Standard ISO9613-2 standard. Standard conditions of 70°F and 50 percent relative humidity were assumed. As a conservative measure, ground absorption or atmospheric attenuation were not included in the model setup. A database was developed which specified the location and sound power levels of each noise source. A receptor grid was specified which covered the entire area of interest. The model calculated the overall A-weighted sound pressure levels within the receptor grid based on the sound level contribution of each noise source. Finally, a noise contour plot was produced based on the overall sound pressure levels within the receptor grid.

Generating Station Noise Sources

The primary noise producing equipment and quantities used in the model runs for the station operation were provided by Black and Veatch (Attachment 1) and are summarized below in Table 5-1.

Table 5-1 Primary Noise Sources

Equipment Source	Quantity	Sound Pressure or Power Level, dB Octave Band Center Frequency, Hz 63	125	250	500	1K	2K	4K	8K	Overall Reference Sound Levels (dBA)
Combustion Turbine	2	94	93	81	78	81	78	76	67	85[1,3]
Exhaust Duct	2	86	84	85	79	79	79	77	66	85[1]
Combustion Turbine Generator	2	94	88	82	81	80	77	75	68	85[1,3]
Combustion Turbine Inlet	2	85	88	78	77	80	79	76	67	85[1]
Exhaust Expansion Joint	2	90	88	88	85	89	89	89	83	95[1]
Heat Recovery Steam Generator Boiler	2	122	115	103	94	82	87	82	76	102[2]
Stack Exit	2	127	127	122	115	101	89	81	79	117[2]
Transition	2	131	124	111	102	97	102	101	105	113[2]
Steam Turbine	2	84	86	88	83	79	73	65	55	85[3]
Steam Turbine Generator	2	94	88	82	81	80	77	75	68	85[3]
Boiler Feed Pump	2	83	79	81	84	87	86	82	79	106[2,3]
Circulating Water Pump	4	98	96	95	94	93	92	91	87	99[2,3]
Cooling Water Pump	2	104	102	101	100	99	98	97	93	105[2,3]
Condensate Pump	2	104	102	101	100	99	98	97	93	105[2,3]
Turbine Exhaust Gas Fan	2	92	93	86	78	75	88	94	90	97[2]
Tower Fan	2	111	111	108	105	101	98	95	87	117[2]
Tower Inlet	2	103	100	96	91	92	92	93	92	99[2]
Auxiliary Transformer	2	103	105	100	100	94	89	84	77	100[2]
Generator Step-up Transformer	6	108	110	105	105	89	94	89	82	105[2]

Notes:
[1] Sound Pressure Level at 3 feet (dBA)
[2] Sound Power Level dBA
[3] Noise source located within generation building

6. Predicted Station Operating Noise

Station Noise

As indicted by the noise contour levels in Figure 6-1, during operation of the project, potential noise impacts would generally be limited to the vicinity of the new generator station. As seen in the figure, modeled noise levels for the facility operation drop to 10 to 15 decibels within approximately 0.5 mile from the generating facility. Modeling indicated there would be no measureable contribution to ambient noise levels at the two closest noise sensitive properties, which are approximately 5 miles away. Since the potential noise impacts to noise sensitive properties from the Carty Generating Station is zero, there would be no change to ambient noise levels when both the Boardman Plant and the Carty Generating Station are operating at maximum capacity.

Table 6-1 presents the noise levels predicted by the model for the nearest residential receptors. As presented in the table, due to the distance from the proposed station to the residential receptors, there would be no measureable contribution to the existing ambient noise level from the operation of the proposed Carty Generating Station. Therefore, noise levels resulting from the operation of the proposed Carty Generating Station would not be audible at the nearest residential receptors and would not result in noise levels above the DEQ limits.

Table 6-1 Estimated Station Operating Noise Levels

	Sound Levels in dBA				
Receptor Location	Station Contribution	Lowest Ambient Hourly L_{50}	Ambient Plus Station Contribution	OAR Standard L_{50} + 10	OAR Table 8 Evening L_{50} Limit
Dairy Housing	0	27	27	37	50
Crawford Residence	0	16	16	26	50

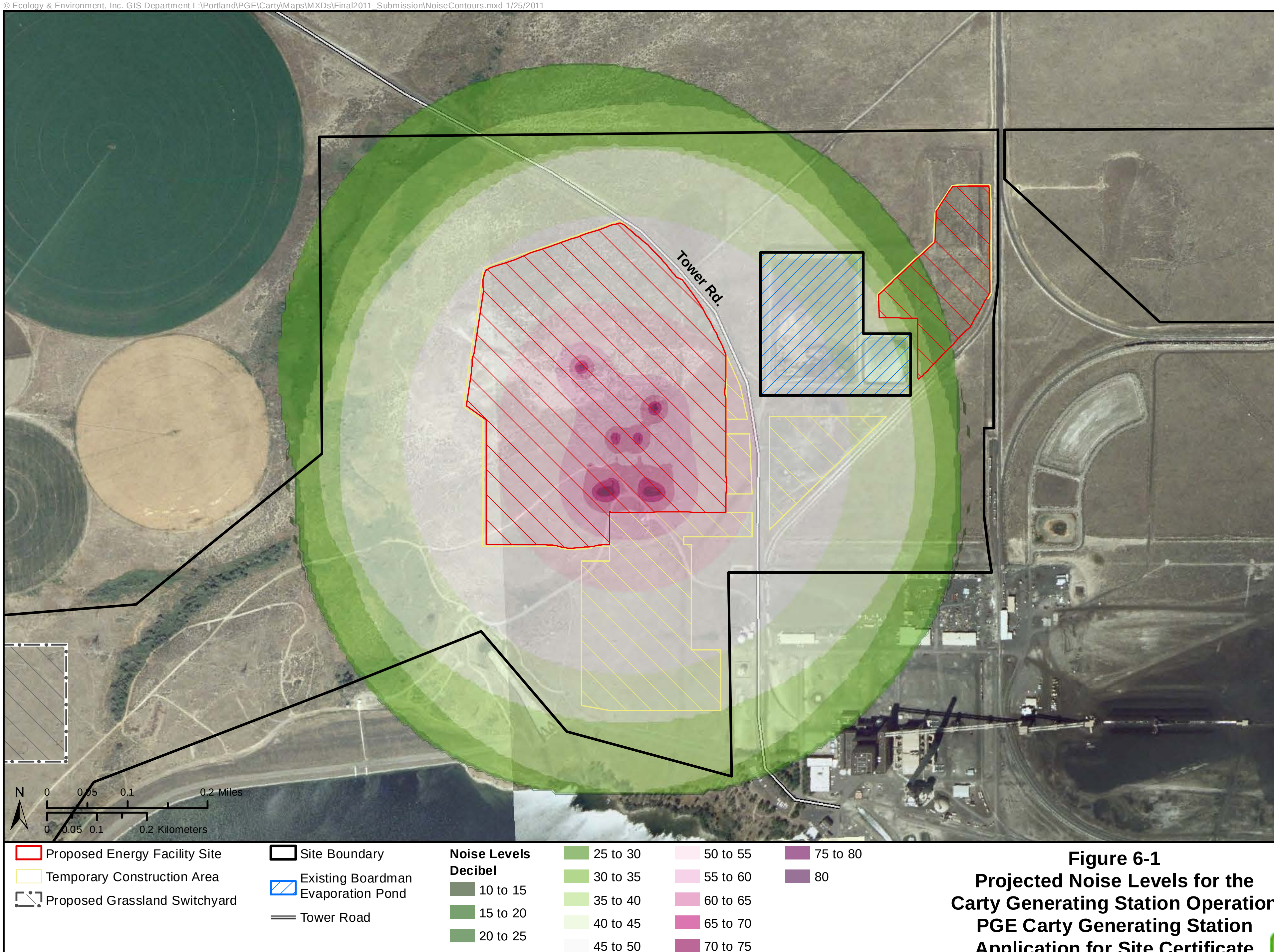


Figure 6-1
Projected Noise Levels for the Carty Generating Station Operation
PGE Carty Generating Station
Application for Site Certificate

Final 2011

7. Construction Noise

Generating Station

Construction of the generator station would involve clearing and grading, placement of fill, and excavation for foundations for the turbine, generator and boiler units, ancillary equipment, piping, and structures. Construction is expected to begin in approximately 2012. No construction activities related to the proposed Carty Generating Station, with the exception of survey and testing activities, are expected prior to 2012.

As part of this analysis, acoustic noise modeling was conducted to estimate the construction noise levels at residential receptors around the site. The algorithm used in the model considered the construction equipment type, numbers of each type, equipment noise emission data, usage factors, and relative distances of the noise-sensitive receptor to the source of noise.

The following logarithmic equation was used to compute projected noise levels:

$$L_{eq}\text{ (equip)} = \text{E.L.} + 10_{Log}(\text{U.F.}) - 20_{log}(D/50) - 10G\ _{log}(D/50) \qquad \text{(eq.) 7-1}$$

where:

L_{eq} (equip) is the L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period.
E.L. is the noise emission level of the particular piece of equipment at the reference distance of 50 feet (U. S. Department of Transportation Federal Highway Administration Table 9.1).
U.F. is a usage factor that accounts for the fraction of time that the equipment is in use over the specified time period.
D is the distance from the receiver to the piece of equipment.
G is a constant that accounts for topography, natural and man-made barriers, and ground effects.

In this case, as a conservative measure, ground effects were ignored and therefore G was equal to 0.

The construction noise modeling was conservative in that it did not include credits for atmospheric absorption, ground attenuation, or the noise-reducing effect of the terrain.

Typical power station construction equipment types and were used in the noise calculations for the project. Noise emission levels were gathered from equipment manufacturers and government agency references. The usage factors were selected from the *FHWA Highway Construction Noise Handbook* (U.S. Department of Transportation August 2006). Usage factors are used to account for the intermittent use of construction equipment throughout the course of a normal workday.

Once the average noise level for an individual equipment unit was calculated, the contributions of all major noise-producing equipment on-site were added to provide a total noise level at each noise-sensitive receptor using the following formula:

$$Leq_{total} = 10\log\left(10^{\frac{Leq_1}{10}} + 10^{\frac{Leq_2}{10}} + 10^{\frac{Leq_3}{10}} ...etc.\right) \qquad \text{eq. 7-2}$$

Table 7-1 presents typical maximum SPLs at various distances for the construction equipment that would be operating during station construction. Since the nearest noise-sensitive receptor to the generator Station site is nearly five miles from the site, the estimated maximum noise contribution due to station construction at five miles would be 35 dBA which would increase the noise level at the nearest receptors during times of lower ambient noise. These levels might occur temporarily over the course of the station construction but would be barely audible at the noise receptor locations at times. However, construction activities would likely occur during daylight hours and as such would have little impact on residential receptors.

Table 7-1 Sound Pressure Levels for Typical Generating Station Construction

Equipment	Reference dBA @ 50 feet	Number of Devices [c]	Usage (%) [b]	Estimated Maximum Noise Level (dBA) at the Specified Distance from the Source (feet)					
				50	100	250	500	1,000	5 Miles
Pickup Truck	55	6	40	59	53	45	39	33	4
Welding Truck, 1-ton	55	8	40	60	54	46	40	34	6
Welding Machine	73	8	40	78	72	64	58	52	24
Backhoe	80	1	40	76	70	62	56	50	22
Trac-Hoe	85	1	40	81	75	67	61	55	27
Skid-Steer Loader	80	1	40	76	70	62	56	50	22
Fork Lift	80	1	40	76	70	62	56	50	22
JLG Lift	85	1	20	78	72	64	58	52	24
80- and 40-ton Picker	85	2	16	80	74	66	60	54	26
185 Air Compressor	80	1	40	76	70	62	56	50	22
Generator	82	2	50	82	76	68	62	56	28
Loader	80	1	40	76	70	62	56	50	22
Dump Truck	84	1	40	80	74	66	60	54	26
Hydrovac Unit	85	1	40	81	75	67	61	55	27
Total Worst-Case Result [a]				**90**	**84**	**76**	**70**	**64**	**35**

Notes:
(a) The worst-case result is derived by adding the individual equipment noise levels logarithmically using equation 7-2.
(b)Source: Federal Highway Administration 2006.
(c) Quantity based on schedule when all equipment is on site.

Key:
dBA = A-weighted decibels.

Transmission Line

Transmission line construction activities would cause short-term impacts in the surrounding area. Noise levels would result from the operation of construction equipment and vehicles traveling to and from the site. Construction of new transmission lines would involve four general procedures that include site preparation, foundation construction, structure construction, and wire-stringing operations. Construction equipment to be used on the project is presented in Table 7-2 along with expected sound pressure levels at various distances.

Table 7-2 Typical Transmission Line Construction Noise Levels at Various Distances

Construction Equipment	Quantity	Usage Factor %*	SPL @ 50 Feet* (dBA)	Adjusted SPL @ 50 Feet (dBA)	SPL @ 100 Feet (dBA)	SPL @ 250 Feet (dBA)	SPL @ 500 Feet (dBA)	SPL @ 1000 Feet (dBA)
Backhoe	1	40	80	76	70	62	56	50
Auger	2	20	85	81	75	67	61	55
Bucket Truck	2	40	85	84	78	70	64	58
18 Wheeler	1	40	84	80	74	66	60	54
Pickup Trucks	1	40	55	51	45	37	31	25
Flatbed Truck	1	40	84	80	74	66	60	54
			Total	**87**	**81**	**73**	**67**	**61**

*Source FHWA 2006

The transmission line construction activities may result in minor noise disturbances at the nearest receptors to the transmission line but they would only occur as the construction progresses through a given area and would therefore be temporary in nature. The two closest receptors are located approximately 880 feet and approximately 1,400 feet from the proposed new transmission line towers. These two distances correspond to construction noise levels of between 67 and 61 dBA, and less than 61 dBA respectively. In both cases the statistical noise levels measured on November 12, 2009 were higher than the predicted construction contribution. Transmission line tower construction would occur during daylight hours and as such would have limited impact on residential receptors. In addition, OAR 340-035-0035(5) excludes construction activities from the noise regulation requirements.

8. References

International Standards Organization. December 15, 1996. ISO 9613-2, Acoustics-Attenuation of Sound During Propagation Outdoors.

New York State Department of Environmental Conservation. June 3, 2002 (rev.). Program Policy DEP-00-1, *Assessing and Mitigating Noise Impacts.*

The State of Oregon Administrative Rule. January 2008. Department of Environmental Quality, Division 35, Noise Control Regulations.

U.S. Department of Transportation. August 2006. *FHWA Highway Construction Noise Handbook.*

APPENDIX X-1
ATTACHMENT 1

Noise Emission Levels Memorandum

BLACK & VEATCH

MEMORANDUM

PGE — B&V Project 162110

Carty Generating Station

Typical Sound Data for Major Equipment — November 12, 2009

To: Jim Gettinger

From: Ryan Baker

As requested, we have compiled typical equipment sound data for the proposed Carty Generating Station. Based on the plant arrangement depicted in Drawing 162110-1CFA-S3810A (dated 10/15/09) and experience with the Port Westward CCPP project, the primary noise sources associated are anticipated to include the following:

- M501G combustion turbine generator (CTG) package.
- Heat recovery steam generator (HRSG) package.
- Steam turbine generator (STG) package.
- Boiler feed pump/motor assemblies.
- Circulating water pump/motor assemblies.
- Condensate pump/motor assemblies.
- Closed cycle cooling water pump/motor assemblies.
- 7-cell cooling tower.
- TEG recirculating fan/motor assemblies.
- Turbine enclosure compartment vent fans and discharge.
- Generator step-up transformers.
- Auxiliary transformers.

Typical equipment sound levels for the primary noise sources are listed in Tables 1 through 9. Included in these tables is the sound power or sound pressure level associated with standard packaged equipment, i.e. without any special noise mitigation upgrades, as would typically be guaranteed by the equipment vendors for no added cost. All equipment sound data is based on available project-specific equipment data and in-house manufacturer data. All final project-specific equipment sound level data should be verified with the appropriate manufacturers. The equipment data is being provided to support the facility noise modeling being conducted by others. Data includes expected octave band sound levels for each noise source, when available, and corresponding equipment sound level specifications based on normal operation of the equipment. Normal operation excludes start-up, shutdown, bypass, and other upset or emergency conditions. The corresponding far-field and near-field equipment sound level specifications are included for reference. The equipment envelope is defined as the perimeter line that encompasses all associated equipment and is positioned 3 feet from the face of the equipment.

If we have failed to identify any major equipment associated with the proposed combined cycle power plant or if you have any questions please let me know.

RLB

cc: Brent Ferren

MEMORANDUM

PGE
Carty Generating Station
Typical Sound Data for Major Equipment

B&V Project 162110

November 12, 2009

<table>
<tr><th colspan="11">Table 1.
COMBUSTION TURBINE GENERATOR (CTG) PACKAGE</th></tr>
<tr><td colspan="11">The CTG package is located within the generation building. The noise radiating from the CTG package contributes to the overall noise that transmits through the generation building walls, roof, and louvers. Additionally, portions of the air inlet and exhaust duct are located outdoors which contribute to the environmental noise emissions.</td></tr>
<tr><th colspan="10">Expected Octave Band Sound Pressure Level at 3 feet (SPL), dB</th><th rowspan="3">Overall SPL, dBA</th></tr>
<tr><th rowspan="2">Source Component</th><td colspan="9">Octave Band Center Frequency, Hz</td></tr>
<tr><td>31.5</td><td>63</td><td>125</td><td>250</td><td>500</td><td>1k</td><td>2k</td><td>4k</td><td>8k</td></tr>
<tr><td>CT Inlet
(Face, Plenum, Duct)</td><td>95</td><td>85</td><td>88</td><td>78</td><td>77</td><td>80</td><td>79</td><td>76</td><td>67</td><td>85</td></tr>
<tr><td>Turbine Enclosure</td><td>90</td><td>94</td><td>93</td><td>81</td><td>78</td><td>81</td><td>78</td><td>76</td><td>67</td><td>85</td></tr>
<tr><td>Generator</td><td>106</td><td>94</td><td>88</td><td>82</td><td>81</td><td>80</td><td>77</td><td>75</td><td>68</td><td>85</td></tr>
<tr><td>Exhaust Duct</td><td>88</td><td>86</td><td>84</td><td>85</td><td>79</td><td>79</td><td>79</td><td>77</td><td>66</td><td>85</td></tr>
<tr><td>Exhaust Expansion Joint</td><td>93</td><td>90</td><td>88</td><td>88</td><td>85</td><td>89</td><td>89</td><td>89</td><td>83</td><td>95</td></tr>
<tr><th colspan="10">Expected Octave Band Sound Power Level (L_w), dB</th><th rowspan="3">Overall $L_{w,}$, dBA</th></tr>
<tr><th rowspan="2">Source Component</th><td colspan="9">Octave Band Center Frequency, Hz</td></tr>
<tr><td>31.5</td><td>63</td><td>125</td><td>250</td><td>500</td><td>1k</td><td>2k</td><td>4k</td><td>8k</td></tr>
<tr><td>Turbine Comp. Vent Fan (Discharge)</td><td>95</td><td>96</td><td>97</td><td>90</td><td>82</td><td>79</td><td>92</td><td>98</td><td>94</td><td>101</td></tr>
<tr><td>Turbine Comp. Vent Fan (Housing)</td><td>85</td><td>86</td><td>87</td><td>80</td><td>72</td><td>69</td><td>82</td><td>88</td><td>84</td><td>91</td></tr>
<tr><th colspan="11">Corresponding Equipment Sound Level Specifications</th></tr>
<tr><td>Far-field
(Overall Package)</td><td colspan="10">Not Applicable – Indoor CTG.</td></tr>
<tr><td>Far-field
(Air Inlet System)</td><td colspan="10">Maximum A-weighted sound pressure level of 65 dBA at a distance of 400 feet in any direction from the inlet system including the noise contribution of the air inlet face, the air inlet plenum, and the inlet ductwork located external to the building.</td></tr>
<tr><td>Near-field
(Overall Package)</td><td colspan="10">Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
<tr><td>Near-field
(Exhaust System)</td><td colspan="10">Exhaust Duct - spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.
Exhaust Expansion Joint - spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 95 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
<tr><td>Near-field (Turbine Comp. Vent Fan)</td><td colspan="10">Fan discharge – spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 98 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.
Fan housing - spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 79 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
</table>

MEMORANDUM

PGE
Carty Generating Station
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Table 2.
HEAT RECOVERY STEAM GENERATOR (HRSG) PACKAGE

The HRSG package is located outdoors. The sources of noise associated with the HRSG package include the transition ductwork, the boiler section, and the stack exit.

Source Component	**Expected Octave Band Sound Power Level (L_w), dB** – Octave Band Center Frequency, Hz: 31.5	63	125	250	500	1k	2k	4k	8k	**Overall $L_{w,}$, dBA**
Transition	126	131	124	111	102	97	102	101	105	113
Boiler	117	122	1115	103	94	82	87	82	76	102
Stack Exit	122	127	127	122	115	101	89	81	79	117

Corresponding Equipment Sound Level Specifications

Far-field (Overall Package)	*Maximum A-weighted sound pressure level (ref: 20 μPa) of 66 dBA at a distance of 400 feet in any direction from the equipment envelope and 5 feet above the ground in a free-field during normal operation of the equipment.*
Near-field (Overall Package)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation. Normal operation excludes start-up, shutdown, and all off-normal and emergency conditions.*

Table 3.
STEAM TURBINE GENERATOR (STG) PACKAGE

The STG package is located within the generation building. The noise radiating from the STG package contributes to the overall noise that transmits through the generation building walls, roof, and louvers.

Source Component	**Expected Octave Band Sound Pressure Level (SPL), dB** – Octave Band Center Frequency, Hz: 31.5	63	125	250	500	1k	2k	4k	8k	**Overall SPL, dBA**
HP/LP Steam Turbine	90	84	86	88	83	79	73	65	55	85
ST Generator	106	94	88	82	81	80	77	75	68	85

Corresponding Equipment Sound Level Specifications

Near-field (Overall Package)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*

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PGE — B&V Project 162110
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Typical Sound Data for Major Equipment — November 12, 2009

Table 4.
PUMPS/MOTORS

The boiler feed, closed cycle cooling water, and condensate pump/motor assemblies are located inside the generation building. The noise radiating from these pump/motor packages contribute to the overall noise that transmits through the respective building walls, roof, and louvers. The Circulating Water Pumps are located outdoors and contribute to the environmental noise emissions.

Source Component	**Expected Octave Band Sound Power Level (L_w), dB**									**Overall L_w, dBA**
	Octave Band Center Frequency, Hz									
	31.5	63	125	250	500	1k	2k	4k	8k	
Boiler Feed Pump	83	83	79	81	84	87	86	82	79	106
Circ. Water Pump	92	98	96	95	94	93	92	91	87	99
Closed Cycle Cooling Water Pump	98	104	102	101	100	99	98	97	93	105
Condensate Pump	98	104	102	101	100	99	98	97	93	105

Corresponding Equipment Sound Level Specifications

Near-field (BFP)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 91 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*
Near-field (Others)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*

Table 5.
TEG RECIRCULATION FANS/MOTOR ASSEMBLY

Two TEG recirculation fan/motor assemblies are located outdoors near the HRSG. The inlet and discharge of these fans are ducted. The noise radiating from the fan casings and motors contribute to the overall facility environmental noise emissions. The fan sound level specifications are as follows:

Source Component	**Expected Octave Band Sound Power Level (L_w), dB**									**Overall L_w, dBA**
	Octave Band Center Frequency, Hz									
	31.5	63	125	250	500	1k	2k	4k	8k	
TEG Fan/motor	91	92	93	86	78	75	88	94	90	97

Corresponding Equipment Sound Level Specifications

Near-field (Overall Assembly)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*

Table 6.
COOLING TOWER PACKAGE

Noise emissions from the Cooling Tower package include the noise associated with fans, gearboxes, motors, and inlet noise. Generally, the noise emissions include all equipment and auxiliary components included in the Cooling Tower manufacturer's scope-of-supply.

Expected Octave Band Sound Power Level (L_w), dB										Overall L_w, dBA
Source Component	Octave Band Center Frequency, Hz									
	31.5	63	125	250	500	1k	2k	4k	8k	
Tower Fan	108	111	111	108	105	101	98	95	87	117
Tower Inlet	103	103	100	96	91	92	92	93	92	99

Corresponding Equipment Sound Level Specifications

Near-field (Overall Package)	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*
Far-field (Overall Package)	*Maximum A-weighted sound pressure level (ref: 20 μPa) of 62 dBA at a distance of 400 feet in any direction from the equipment envelope and 5 feet above the ground in a free-field during normal operation of the equipment.*

Table 7.
TRANSFORMERS

Noise emissions from the Generator Step-up Transformer (GSUT) and Auxiliary Transformers include the noise associated with operation at maximum cooling capacity, i.e. with all cooling fans operating at full load.

Expected Octave Band Sound Power Level (L_w), dB										Overall L_w, dBA
Source Component	Octave Band Center Frequency, Hz									
	31.5	63	125	250	500	1k	2k	4k	8k	
GSUT	102	108	110	105	105	89	94	89	82	105
Auxiliary Transformer	97	103	105	100	100	94	89	84	77	100

Corresponding Equipment Sound Level Specifications

Specification (GSUT)	*The GSUT transformers shall not exceed a maximum A-weighted sound pressure level (ref: 20 μPa) of 85 dBA, as measured in accordance with ANSI/IEEE C57.12.90.*
Specification (Aux)	*The Auxiliary transformers shall not exceed a maximum A-weighted sound pressure level (ref: 20 μPa) of 80 dBA, as measured in accordance with ANSI/IEEE C57.12.90.*

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<table>
<tr><td colspan="11">Table 8.
GENERATION BUILDING SPECIFICATIONS</td></tr>
<tr><td colspan="11">The acoustical performance of the associated HVAC and wall/roof assemblies has been estimated based on the available information.</td></tr>
<tr><td>Bldg. Component</td><td colspan="9">Description</td><td>Specification</td></tr>
<tr><td>Gen Bldg. Walls</td><td colspan="9">24 gauge metal outer panel and 4-inch thick encapsulated fiberglass insulation with interior liner panel positioned at grade to an elevation of 8 feet above the finished floor as well as along platform areas on the mezzanine and operating floors.</td><td>STC 31</td></tr>
<tr><td>Gen Bldg. Roof</td><td colspan="9">Standing seam 22 gauge metal roofing with 6-inch thick encapsulated fiberglass insulation with no interior liner panel.</td><td>STC 33</td></tr>
<tr><td colspan="10">Expected Octave Band Sound Power Level (L_w) per component, dB</td><td rowspan="3">Overall L_w, dBA</td></tr>
<tr><td rowspan="2">Source Component</td><td colspan="9">Octave Band Center Frequency, Hz</td></tr>
<tr><td>31.5</td><td>63</td><td>125</td><td>250</td><td>500</td><td>1k</td><td>2k</td><td>4k</td><td>8k</td></tr>
<tr><td>Gen Bldg. Wall Fans
(10 total)</td><td>-</td><td>87</td><td>88</td><td>85</td><td>82</td><td>80</td><td>76</td><td>74</td><td>68</td><td>85</td></tr>
<tr><td>Gen Bldg. PRV
(12 total)</td><td>-</td><td>95</td><td>94</td><td>92</td><td>92</td><td>90</td><td>88</td><td>85</td><td>82</td><td>95</td></tr>
<tr><td>Gen Bldg. Roof Mounted AHU
(4 total)</td><td>-</td><td>97</td><td>91</td><td>92</td><td>88</td><td>84</td><td>79</td><td>75</td><td>71</td><td>90</td></tr>
<tr><td colspan="11">Corresponding Equipment Sound Level Specifications</td></tr>
<tr><td>Near-field
(Wall Fans)</td><td colspan="10">Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 74 dBA measured along the equipment envelope at a distance of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
<tr><td>Near-field
(PRV)</td><td colspan="10">Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 85 dBA measured along the equipment envelope at a distance of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
<tr><td>Near-field
(AHU)</td><td colspan="10">Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 78 dBA measured along the equipment envelope at a distance of 5 feet above the ground and all personnel platforms during normal operation.</td></tr>
</table>

MEMORANDUM

PGE
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Table 9.
BFP BUILDING SPECIFICATIONS

Details of the Boiler Feed Pump Building are assumed to be consistent with PGE's Port Westward facility. The acoustical performance of the associated HVAC and wall/roof assemblies has been estimated based on the available information.

Bldg. Component	Description	Specification
BFP Bldg. Walls	*24 gauge metal outer panel and 4-inch thick encapsulated fiberglass insulation with interior liner panel positioned at grade to an elevation of 8 feet above the finished floor as well as along platform areas on the mezzanine and operating floors.*	STC 31
BFP Bldg. Roof	*Standing seam 22 gauge metal roofing with 6-inch thick encapsulated fiberglass insulation with no interior liner panel.*	STC 33

Expected Octave Band Sound Power Level (L_w) per component, dB										Overall L_w, dBA
Source Component	Octave Band Center Frequency, Hz									
	31.5	63	125	250	500	1k	2k	4k	8k	
BFP Bldg. Wall Fans (2 total)	-	81	82	79	76	73	69	68	64	79

Corresponding Equipment Sound Level Specifications	
Near-field	*Spatially averaged A-weighted sound pressure level (ref: 20 μPa) of 70 dBA along the equipment envelope at a height of 5 feet above the ground and all personnel platforms during normal operation.*

APPENDIX X-2

Field Data Sheets and Equipment Calibration Documentation

rev. 5/06

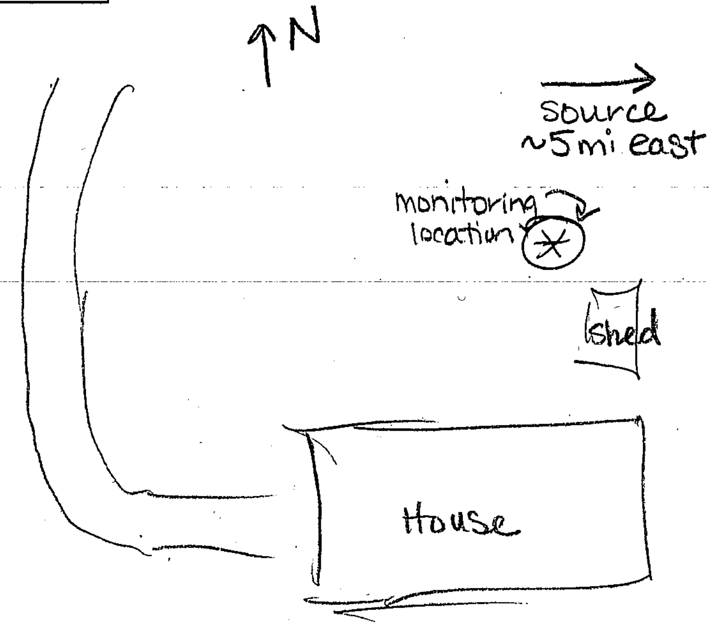
NOISE STUDY FIELD SHEET

C4800 Driveway Number

Site Location: Dairy Housing Three mile Farms	NOISE SPECIALIST: T. Stern/L. Cope
Purpose: Background monitoring	DATE: 11-12-09
Conditions:	WEATHER: 50's Partly Cloudy
	Ground Conditions: Lawn

LOCATION:	At Dairy Housing
Run Number:	
Start Time	12:12 11/12/09
Stop Time	12:10 11/16/09
L_{eq} Day	
Peak	
Max	
Run Time	97 hr. 58 min

Site Sketch



NOISE METER:	CALIBRATOR:
MAKE: NL-31 RION	MAKE: B+K
MODEL: NL-31	MODEL: 4231
SER. NUMBER: 00662630	SER. NUMBER: 2394049
FACTORY CALIBRATION DATE: 11/8/09	FACTORY CALIBRATION DATE: 3-19-09
FIELD CALIBRATION DATE: 11-12-09	94.0 dBA Cal. Field

Notes:

Dogs in area
Poplar Trees nearby leaves on
open fields
New batteries installed, light wind and windscreen installed.
Source located approx. 5 miles east, seperated by relatively
flat agricultural lands.

Photo: yes
File Saved:

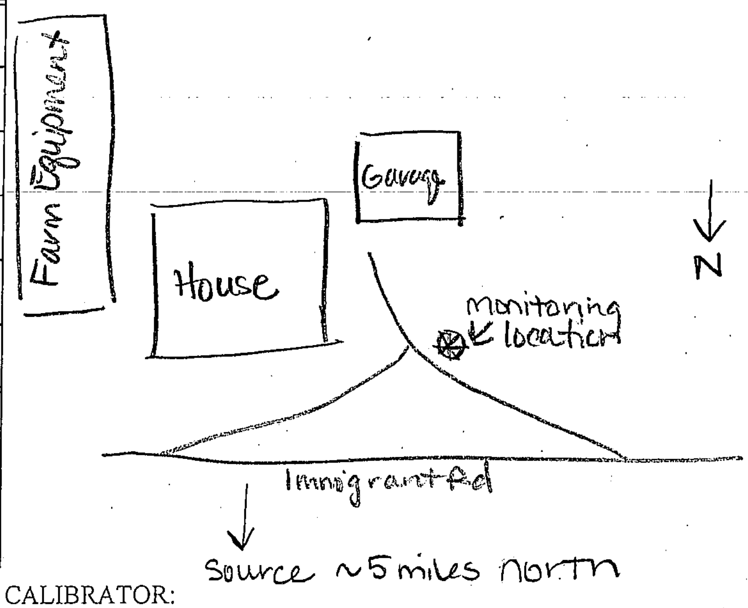
rev. 5/06

NOISE STUDY FIELD SHEET

Site Location: Helen Crawford	NOISE SPECIALIST: T Siener/L. Cope
Purpose: Background monitoring	DATE: 11/12/09
Conditions:	WEATHER: 50's Partly Cloudy
	Ground Conditions: gravel driveway adjacent.

LOCATION:	68280 Immigrant Lane
Run Number:	
Start Time	14:18 11/12/09
Stop Time	16:32 11/16/09
L_{eq} Day	
Peak	
Max	
Run Time	98 hrs, 14 min

Site Sketch



NOISE METER:	CALIBRATOR:
MAKE: Rion	MAKE: B+K
MODEL: NL-31	MODEL: 4231
SER. NUMBER: 00952278	SER. NUMBER: 2394049
FACTORY CALIBRATION DATE: 1/8/2009	FACTORY CALIBRATION DATE: 3-10-09
FIELD CALIBRATION DATE: 11/12/2009	94.0 dBA cal. field

Notes:
on fence post adjacent to gravel driveway ~ 20 feet from gravel immigrant Road. Farm Equipment onsite. New batteries installed, light wind and windscreen installed. Source located approx. 5 miles north seperated by rolling hills.

Photo: yes
File Saved:

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19171

Instrument:	**Sound Level Meter**
Model:	**NL31**
Manufacturer:	**Rion**
Serial number:	**00662630**
Tested with:	**Microphone UC53A s/n 310197** **Preamplifier NH-21 s/n 19449**
Type (class):	1

Date Calibrated: **1/8/2009**

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ **Yes** _X_ **No**

Calibration service: __ **Basic** _X_ **Standard**

Customer: **Scantek, Inc.**
Tel/Fax: **410-290-7726/ -9167**

Address: **6450 Dobbin Road, Suite A**
Columbia, MD 21045

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Jan 2, 2009	Scantek, Inc.	Jan 2, 2010
DS-360-SRS	Function Generator	33584	Jan 3, 2008	Davis Calibration / AClass	Jan 3, 2010
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Aug 19, 2008	ACR Env. / A2LA	Aug 14, 2009
HM30-Thommen	Meteo Station	1040170/39633	Dec 21, 2007	Transcat / A2LA	Jun 21, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc.	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.8 °C	98.98 kPa	33.4 %RH

Calibrated by	Javier Albarracin	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	1/8/2009	Date	1/9/2009

Document stored as: Z:\Calibration Lab\SLM 2009\RIONL31_00662630_M1.doc

Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	MET [2,3]	NOT MET	MEASUREMENT EXPANDED UNCERTAINTY (coverage factor 2) [dB]
IEC 60651/ANSI S1.4			
Input Amplifier Test: Gain Step test/Amplifier Setting (# 6.3/5.3)	X		0.15
Level Linearity Test (#7.9/ 6.9)	X		0.15
Differential Level Linearity (#7.10/6.10)	X		0.21
Weighting Network Tests: A, C, Lin network (#7.2.1/ 6.2.1-electrical test)	X		0.15
Overload Detector Test: A-network (#9.3.1/8.3.1)	X		0.15
F/S/I/Peak Test: Steady State Response (#7.4/ 6.4)	X		0.15
Fast and Slow Overshoot Test (# 8.4.1)	X		0.15
Fast-Slow Test: Single Sine Wave Burst (9.4.1&9.4.3/8.4.1 & 8.4.3)	X		0.15
RMS Detector Test: Continuous Sine Wave Burst (#9.4.2/8.4.2)	X		0.15
RMS Detector Test: Crest Factor Test (#9.4.2/ 8.4.2)	X		0.15
IEC60804/ANSI S1.43			
Level linearity Test (# 9.3.3/8.3.3)	X		0.15
Time Averaging Test (#9.3.2/ 8.3.2) (Leq and LE)	X		0.15/0.17
Acoustical Test: Accuracy at selected frequencies	X		0.15

1 The results of this calibration apply only to the instrument type with serial number identified in this report

2 Parameters are certified at actual environmental conditions

3 The tests marked with (*) are not covered by the current NVLAP accreditation

Comments: The instrument was tested and met all specifications found in the referenced procedures

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger. Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the instrument:

X	Microphone UC53A s/n 310197 for acoustical test
X	Preamplifier NH-21 s/n 19449 for all tests
X	Other: line adaptor ADP005 (18pF) for electrical tests

Measured Data: in Test Report # 19171 of 8+1 pages.

Place of Calibration: Scantek, Inc.
6450 Dobbin Road, Suite A
Columbia, MD 21045 USA

Ph/Fax: 410-290-7726/ -9167
info@scantekinc.com

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19167

Instrument:	**Sound Level Meter**	*Date Calibrated:*	**1/8/2009**
Model:	**NL31**	*Status:*	**Received** / **Sent**
Manufacturer:	**Rion**	*In tolerance:*	X / X
Serial number:	**00952278**	*Out of tolerance:*	
Tested with:	**Microphone UC53A s/n 309106**	*See comments:*	
	Preamplifier NH-21 s/n 17130	*Contains non-accredited tests:*	__Yes X No
Type (class):	**1**	*Calibration service:*	__ Basic X Standard
Customer:	**Scantek, Inc.**	*Address:*	**6450 Dobbin Road, Suite A**
Tel/Fax:	**410-290-7726/ -9167**		**Columbia, MD 21045**

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Jan 2, 2009	Scantek, Inc.	Jan 2, 2010
DS-360-SRS	Function Generator	33584	Jan 3, 2008	Davis Calibration / AClass	Jan 3, 2010
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Aug 19, 2008	ACR Env. / A2LA	Aug 14, 2009
HM30-Thommen	Meteo Station	1040170/39633	Dec 21, 2007	Transcat / A2LA	Jun 21, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc.	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.7 °C	98.74 kPa	34.6 %RH

Calibrated by	Javier Albarracin	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	1/8/2009	Date	1/9/2009

Document stored as: Z:\Calibration Lab\SLM 2009\RIONL31_00952278_M1.doc

Results summary: Device complies with following clauses of mentioned specifications:

CLAUSES [1] FROM IEC/ANSI STANDARDS REFERENCED IN PROCEDURES:	MET [2,3]	NOT MET	MEASUREMENT EXPANDED UNCERTAINTY (coverage factor 2) [dB]
IEC 60651/ANSI S1.4			
Input Amplifier Test: Gain Step test/Amplifier Setting (# 6.3/5.3)	X		0.15
Level Linearity Test (#7.9/ 6.9)	X		0.15
Differential Level Linearity (#7.10/6.10)	X		0.21
Weighting Network Tests: A, C, Lin network (#7.2.1/ 6.2.1-electrical test)	X		0.15
Overload Detector Test: A-network (#9.3.1/8.3.1)	X		0.15
F/S/I/Peak Test: Steady State Response (#7.4/ 6.4)	X		0.15
Fast and Slow Overshoot Test (# 8.4.1)	X		0.15
Fast-Slow Test: Single Sine Wave Burst (9.4.1&9.4.3/8.4.1 & 8.4.3)	X		0.15
RMS Detector Test: Continuous Sine Wave Burst (#9.4.2/8.4.2)	X		0.15
RMS Detector Test: Crest Factor Test (#9.4.2/ 8.4.2)	X		0.15
IEC60804/ANSI S1.43			
Level linearity Test (# 9.3.3/8.3.3)	X		0.15
Time Averaging Test (#9.3.2/ 8.3.2) (Leq and LE)	X		0.15/0.17
Acoustical Test: Accuracy at selected frequencies	X		0.15

1 The results of this calibration apply only to the instrument type with serial number identified in this report

2 Parameters are certified at actual environmental conditions

3 The tests marked with (*) are not covered by the current NVLAP accreditation

Comments: The instrument was tested and met all specifications found in the referenced procedures

Note: The instrument was tested for the parameters listed in the table above, using the test methods described in the listed standards. All tests were performed around the reference conditions. The test results were compared with the manufacturer's or with the standard's specifications, whichever are larger. Compliance with any standard cannot be claimed based solely on the periodic tests.

Tests made with the following attachments to the Instrument:

X	Microphone UC53A s/n 309106 for acoustical test
X	Preamplifier NH-21 s/n 17130 for all tests
X	Other: line adaptor ADP005 (18pF) for electrical tests

Measured Data: in Test Report # 19167 of 8+1pages.

Place of Calibration: Scantek, Inc.
6450 Dobbin Road, Suite A
Columbia, MD 21045 USA

Ph/Fax: 410-290-7726/ -9167
info@scantekinc.com

EXHIBIT Y

CARBON DIOXIDE EMISSIONS
OAR 345-021-0010(1)(y)

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Y.1 INTRODUCTION

OAR 345-021-0010(1)(y) *If the facility is a base load gas plant, a non-base load power plant, or a nongenerating energy facility that emits carbon dioxide, the application for site certificate for the proposed Carty Generating Station must contain a statement of the means by which applicant elects to comply with the applicable carbon dioxide emissions standard under OAR 345-024-0560, OAR 345-024-0600, or OAR 345-024-0630 and information, showing detailed calculations, about the carbon dioxide emissions of the energy facility.*

Response: To issue a site certificate, "the Council (Energy Facility Siting Council [EFSC]) must find that the energy facility complies with any applicable carbon dioxide emissions standard adopted by the Council (EFSC) or enacted by statute," Oregon Administrative Rule (OAR) 345-024-0500. The Carty Generating Station would be a base load gas plant as defined in OAR 345-001-0010(7). Therefore, "the Council (EFSC) must find that the net carbon dioxide emissions rate of the proposed facility does not exceed 0.675 pounds of carbon dioxide per kilowatt hour (lb CO2/kWh) of net electric power output, with carbon dioxide emissions and net electric power output measured on a new and clean basis," OAR 345-024-0550.

Additionally, the Carty Generating Station may include power enhancement or augmentation in the form of duct burning. Duct burning would be fueled with natural gas and is not expected to exceed 3,000 hours per year. Portland General Electric Company (PGE) may select a lower limit for annual average hours of duct firing prior to beginning construction, pursuant to OAR 345-024-0590(4). EFSC applies the carbon dioxide emissions standard for non-base load power plants to the incremental carbon dioxide emissions from the designed operation of the power enhancement or augmentation options OAR 345-024-0590. Thus, EFSC must find that those incremental emissions do not exceed 0.675 lb of carbon dioxide (CO2)/kilowatt hours (kWh) of net electric power output, with CO2 emissions and net electric output measures on a new and clean basis.

Y.2 SUMMARY

This exhibit provides information on compliance with the carbon dioxide emissions standard, as required by OAR 345-021-0010(1)(y). PGE would comply with the carbon dioxide emissions standard of OAR 345-024-0550 and OAR 345-024-0590 for the Carty Generating Station by providing offset funds to The Climate Trust (formerly the Oregon Climate Trust), as allowed by OAR 345-024-0560(3) and OAR 345-024-0600(3). PGE's payments would be made in compliance with the monetary path payment requirement of OAR 345-024-0710. The gross CO2 emissions rates are estimated to be 0.768 pounds (lbs) of CO2/kWh for the base load element, and 0.800 lbs CO2/kWh with power augmentation, resulting in an excess carbon dioxide emission of 0.093 lbs CO2/kWh for the base load element and 0.125 lbs CO2/kWh with power augmentation.

Y.3 FUEL CYCLE AND USAGE

OAR 345-021-0010(1)(y)(A) *Exhibit Y shall include information about the fuel cycle and usage including the maximum hourly fuel use at net electrical power output at average annual conditions for a base load gas plant and the maximum hourly fuel use at nominal electric generating capacity for a non-base load power plant or a base load gas plant with power augmentation technologies, as applicable.*

<u>Response:</u> The Carty Generating Station would be fueled by natural gas only and is a combined cycle electrical generating facility. Under normal operating conditions, natural gas would be fired only in the combustion turbine generator, with exhaust gas from the combustion turbine supplying heat to a heat recovery steam generator (HRSG), which produces steam to power a steam turbine. Electricity would be produced by the combustion turbine generator(s) and the steam turbine generator(s). Under average annual operating conditions, the Carty Generating Station is expected to produce a net electrical output of approximately 760 megawatts (MW), with actual output dependent upon the technology selected. Assuming 760-MW output at average annual conditions, the Carty Generating Station would use approximately 5,050 million British thermal units (Btu)/hour (higher heating value [HHV]) or 5.13 million standard cubic feet (SCF) of natural gas per hour.

During periods when power augmentation is used, the Carty Generating Station would fire natural gas in both the combustion turbine(s) and in duct burners in the HRSG. At average annual operating conditions, during periods of power augmentation, the Carty Generating Station is expected to produce a net electrical output of approximately 861 MW, with actual output dependent upon the technology selected. Assuming 861 MW output at average annual conditions during periods of power augmentation, the Carty Generating Station would use approximately 6,000 million Btu/hour (HHV) or 6.1 million SCF of natural gas per hour. This amount of natural gas usage is not in addition to the amount used without power augmentation, but is the total gas used at the plant during periods of power augmentation.

Y.4 GROSS CAPACITY FOR EACH GENERATING UNIT

OAR 345-021-0010(1)(y)(B) *Exhibit Y shall include the gross capacity as estimated at the generator output terminals for each generating unit. For a base load gas plant, gross capacity is based on the average annual ambient conditions for temperature, barometric pressure and relative humidity. For a non-base load plant, gross capacity is based on the average temperature, barometric pressure and relative humidity at the site during the times of year when the facility is intended to operate. For a baseload gas plant with power augmentation, gross capacity in that mode is based on the average temperature, barometric pressure and relative humidity at the site during the times of year when the facility is intended to operate with power augmentation.*

Response: The gross capacity of each generating unit would depend on the final technology selected. The gross capacity of each generating unit for a possible technology, with and without power augmentation, is presented in Table Y-1.

Table Y-1 Gross Capacity For Each Generating Unit

Generation Unit	Gross Capacity at Average Site Conditions (MW)	
	Base Load	Power Augmentation
CTG-1	255	255
CTG-2	255	255
STG-1	135	186
STG-2	135	186
Total	**780**	**882**

Y.5 ON-SITE ELECTRICAL LOADS AND LOSSES

OAR 345-021-0010(1)(y)(C) *Exhibit Y shall include a table showing a reasonable estimate of all on-site electrical loads and losses greater than 50 kilowatts, including losses from on-site transformers, plus a factor for incidental loads, that are required for the normal operation of the plant when the plant is at its designed full power operation.*

Response: A list of all expected electrical loads and losses greater than 50 kilowatts (kW) is shown in Table Y-2. This list is based on a typical technology and will vary with the final technology selected.

Table Y-2 On-site Electrical Loads and Losses

Unit	Base Load		Power Augmentation	
	Electrical Loads (kW)	Electrical Losses (kW)	Electrical Loads (kW)	Electrical Losses (kW)
CTG-1	255000		255000	
CTG-2	255000		255000	
STG-1	135000		186000	
STG-2	135000		186000	
AIR COMPRESSORS		180		180
CLOSED CYCLE COOLING WATER PUMPS		600		600
BOILER FEEDWATER PUMPS		5,600		6,500
CONDENSATE PUMPS		600		600
DEMIN WATER TRANSFER PUMPS		36		36
CONDENSER AIR EXTRACTION		150		150
CIRC WATER PUMPS		3,200		3,200
COOLING TOWER FANS		2,400		2,400

Table Y-2 On-site Electrical Loads and Losses

Unit	Base Load		Power Augmentation	
	Electrical Loads (kW)	Electrical Losses (kW)	Electrical Loads (kW)	Electrical Losses (kW)
SERVICE WATER PUMPS		36		36
RAW WATER PUMPs		150		150
Water treatment and chemical feed		800		800
Gas and steam turbine auxiliaries		1,600		1,600
Economizer recirculation pumps		150		150
HVAC		400		400
DC power supply and UPS		100		100
lighting		200		200
Miscellaneous Controls& Small Loads		700		700
GSU transformer losses		2,700		3,100
Auxiliary Transformer losses		400		440
Net Electrical Output	**760,000**	**-**	**861,000**	

Note: Based on average site conditions.

Y.6 ALTERNATE FUEL USE

OAR 345-021-0010(1)(y)(D) *Exhibit Y shall include maximum number of hours per year and energy content (Btu per year, higher heating value) of alternate fuel use.*

Response: OAR 345-021-0010(1)(y)(D) is not applicable because PGE proposes to use only natural gas as fuel for this energy facility.

Y.7 CALCULATIONS OF CARBON DIOXIDE EMISSIONS

This section describes the detailed calculations of the carbon dioxide emissions of the Carty Generating Station, as required by OAR 345-021-0010(1)(y)(E)-(H). A spreadsheet of expected emissions calculations is provided as Table Y-3. Table Y-4 provides information on how the emission factors used in the base load and power augmentation scenarios were calculated. The emissions calculations provided herein are estimates only. As described in Section Y.4, after technology selection and prior to construction of the energy facility, actual final emissions calculations would be submitted to the Oregon Department of Energy (DOE) to determine the amount of the monetary path offset funds.

Y.7.1 Gross Carbon Dioxide Emissions

OAR 345-021-0010(1)(y)(E) *Exhibit Y shall include the total gross carbon dioxide emissions for 30 years, unless an applicant for a non-base load power plant or nongenerating energy facility proposes to limit operation to a shorter time.*

Response: Gross CO_2 emissions are defined in Oregon Revised Statute (ORS) 469.502(2)(e) as the predicted CO_2 emissions of the Carty Generating Station measured on a new and clean basis.

Gross CO_2 emissions for 30 years' operation at base load, at average site conditions, without power augmentation, were estimated to be approximately 76,700,000 tons of CO_2, as shown in Table Y-3. Gross carbon dioxide emissions for 30 years of operation at base load, at average site conditions, with power augmentation, were estimated to be approximately 81,400,000 tons of CO_2, as shown in Table Y-3.

OAR 345-021-0010(1)(y)(F) *Exhibit Y shall include the gross carbon dioxide emissions rate expressed as:*

(i) Pounds of carbon dioxide per kilowatt-hour of net electric power output for a base load gas plant, including operation with or without power augmentation, as appropriate, or for a non-base load power plant;

(ii) Pounds of carbon dioxide per horsepower hour for nongenerating facilities for which the output is ordinarily measured in horsepower; or

(iii) A rate comparable to pounds of carbon dioxide per kilowatt-hour of net electric power output for nongenerating facilities other than those measured in horsepower;

Response: Net electric power output is defined under OAR 345-001-0010(35) as "the electric power produced or capacity made available for use. Calculation of net electric power output subtracts losses from on-site transformers and power used for any on-site electrical loads from gross capacity as measured or estimated at the generator terminals for each generating unit." Based on the on-site electrical loads and losses in Section Y.5, the net electric power for base load conditions is approximately 760 MW and 861 MW with power augmentation.

The gross CO_2 emissions rates were estimated to be 0.768 lbs CO_2/kWh for base load element, and 0.800 lbs CO_2/kWh with power augmentation, as shown in Table Y-3.

Y.7.2 Excess Carbon Dioxide Emissions

OAR 345-021-0010(1)(y)(G) *Exhibit Y shall include the total excess carbon dioxide emissions for 30 years, unless an applicant for a non-base load power plant or a nongenerating energy facility proposes to limit operation to a shorter time.*

Response: The total excess carbon dioxide emissions for 30 years, including power augmentation during 3000 hours per year, at average site conditions, are estimated to be approximately 11,000, 000 tons of CO_2, as shown in Table Y-3.

OAR 345-021-0010(1)(y)(H) *The excess carbon dioxide emission rate, using the same measure as required for paragraph (F) shall be included in Exhibit Y.*

Response: Paragraph (F) subsection (i) requests gross carbon dioxide emissions in lb CO_2/kWh of net electrical power output. The requested rates were estimated subtracting the carbon dioxide emission standard from the gross carbon emission rates provided in Section Y.7.1. The excess CO_2 emission rate for the base load element is 0.093 lbs CO_2/kWh and 0.125 lbs CO_2/kWh during times of power augmentation, as shown in Table Y-3.

Y.8 SITE CONDITIONS

OAR 345-021-0010(1)(y)(I) *Exhibit Y shall contain the average annual site conditions, including temperature, barometric pressure and relative humidity, together with a citation of the source and location of the data collection devices.*

Response: The annual average site conditions were assumed based on American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) standards using the site elevation and are as follows:

Temperature	55 °F
Barometric Pressure	14.328 pounds per square inch (psi)
Relative Humidity	60 percent

OAR 345-021-0010(1)(y)(J) *For a non-base load power plant (or when using power augmentation), the average temperature, barometric pressure and relative humidity at the site during the times of the year when the facility is intended to operate, together with a citation of the source and location of the data collection devices.*

Response: The annual average site conditions when the power augmentation would be used were assumed based on ASHRAE standards using the site elevation and are as follows:

Temperature	55 °F
Barometric Pressure	14.328 psi
Relative Humidity	60 percent

Y.9 FUEL INPUT

OAR 345-021-0010(1)(y)(K) *Exhibit Y shall contain the annual fuel input in British thermal units, higher heating value, to the facility for each type of fuel the facility will use, assuming:*

(i) For a base load gas plant, a 100-percent capacity factor on a new and clean basis and the maximum number of hours annually that the applicant proposes to use alternative fuels;

(ii) For a non-base load power plant, the applicant's proposed annual hours of operation on a new and clean basis, the maximum number of hours annually that the applicant proposes to use alternative fuels and, if the calculation is based on an operational life of fewer than 30 years, the proposed operational life of the facility;

(iii) For a nongenerating energy facility, the reasonably likely operation of the facility based on one year, 5-year, 15-year, and 30-year averages, unless an applicant proposes to limit operation to a shorter time.

Response: PGE proposes to use only natural gas as fuel for the Carty Generating Station. It is expected that the Carty Generating Station would operate 8,760 hours per year, including 3,000 hours of power augmentation. The expected total annual fuel input would be 47.1 x 10^6 million British thermal units per year.

OAR 345-021-0010(1)(y)(L) *For each type of fuel a base load gas plant or a non-base load power plant will use, the estimated heat rate and capacity of the facility measured on a new and clean basis with no thermal energy to cogeneration, consistent with the data supplied in Exhibit B shall be provided in Exhibit Y.*

Response: PGE proposes to use only natural gas as fuel for the proposed energy facility.

As shown in Table Y-3, the estimated base load net power output is 760 MW, with a capacity of 100 percent and a heat rate of 6,645 Btu/kWh, HHV. With power augmentation, the energy facility has an estimated net power output of 861 MW, with a capacity of 34 percent and heat rate of 6,910 Btu/kWh, HHV. As discussed above, PGE may set a different capacity for power augmentation prior to construction. Note that 6,910 Btu/kWh is the combined effect of the base load plus the impact of the HRSG duct firing for power augmentation.

Y.10 NON GENERATING FACILITY EFFICIENCY AND CAPACITY

OAR 345-021-0010(1)(y)(M) *For each type of fuel a nongenerating energy facility will use, the estimated efficiency and capacity of the facility with no thermal energy to cogeneration.*

Response: OAR 345-021-0010(1)(y)(M) is not applicable.

Y.11 COGENERATION TO LOWER CARBON DIOXIDE EMISSIONS

OAR 345-021-0010(1)(y)(N)(i) through (xii) *If the facility provides thermal energy for cogeneration to lower its net carbon dioxide emissions rate, the applicant shall include:[information outlined in subsection (i) through (xii)].*

Response: The Carty Generating Station would not include cogeneration; therefore, OAR 345-021-0010(1)(y)(N) is not applicable.

OAR 345-021-0010(1)(y)(O)(i) through (xxi) *If the applicant proposes to offset carbon dioxide emissions as described in OAR 345-024-0550(3), 345-024-0560(2), 345-024-0590(3), 345-024-0600(2), 345-024-0620(3) or 345-024-0630(1), the applicant shall include:[information outlined in subsection (i) through (xxi)].*

Response: OAR 345-021-0010(1)(y)(O) is not applicable since all required offsets would be provided through the monetary path.

Y.12 MONETARY PATH

OAR 345-021-0010(1)(y)(P) *If the applicant elects to comply with the applicable carbon dioxide emissions standard by using the monetary path under OAR 345-024-0560(3), 345-024-0600(3) or 345-024-0630(2), the applicant shall include:*

(i) A statement of the applicant's election to use the monetary path;

Response: PGE would comply with the CO2 standards of OAR 345-024-0550 and OAR 345-024-0590 for the proposed energy facility solely by providing offset funds to The Climate Trust, as allowed by OAR 345-024-0560(3) and in compliance with the monetary path payment requirement of OAR 345-024-0710.

(ii) The amount of carbon dioxide reduction, in tons, for which the applicant is taking credit by using the monetary path;

Response: PGE would use the monetary path for the full amount of the CO2 emission reduction required to comply with the CO2 emission standard. Section Y.7 provides an initial calculation of CO2 emissions. Determination of the actual monetary path payment requirement would be in accordance with site certificate conditions.

(iii) The qualified organization to whom the applicant will provide offset funds and funds for the cost of selecting and contracting for offsets. The applicant shall include evidence that the organization meets the definition of a qualified organization under OAR 345-001-0010. The applicant may identify an organization that has applied for, but has not received, an exemption from federal income taxation, but the Council shall not find that

the organization is a qualified organization unless the organization is exempt from federal taxation under section 501(c)(3) of the Internal Revenue Code as amended and in effect on December 31, 1996; and

Response: PGE would provide offset funds, and funds for the cost of selecting and contracting for offsets, to The Climate Trust. For the following reasons, The Climate Trust is a “qualified organization” as defined by OAR 345-001-0010(48):

- The Climate Trust is exempt from federal taxation under section 501(c)(3) of the Internal Revenue Code. By letter dated November 19, 1997, the Internal Revenue Service determined that The Climate Trust (then the Oregon Climate Trust) is exempt from taxation under section 501(c)(3).
- The Climate Trust is incorporated in the State of Oregon. The Articles of Incorporation are filed with the Oregon Secretary of State.
- The Articles of Incorporation of The Climate Trust require that offset funds received under OAR 345-024-0710(3) (ORS 469.503(2)) are to be used for offsets projects that would result in direct reduction, elimination, sequestration, or avoidance of CO2 emissions. The Articles of Incorporation of The Climate Trust require that decisions regarding the use of such funds be made by a body composed of seven voting members, of which three are appointed by EFSC, three are Oregon residents appointed by the Bullitt Foundation, and one is appointed by applicants for site certificates that are subject to ORS 469.503(2)(d) and the holders of such site certificates.
- The Climate Trust has made available on an annual basis, beginning after the first year of operation, a signed opinion of an independent certified public accountant stating that the qualified organization’s use of funds pursuant to ORS 469.503 conforms with generally accepted accounting principles.
- The Climate Trust has provided DOE with documentation that the Climate Trust has complied with OAR 345-001-0010(1)(48)(e) (ORS 469.503(2)(e)(K)(v)).

(iv) A statement of whether the applicant intends to provide a bond or letter of credit to secure the funds it must provide to the qualified organization or whether it requests the option of providing either a bond or a letter of credit.

Response: PGE proposes to use a letter of credit or bond to ensure the payment of funds to The Climate Trust.

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)

(a)

Max Fuel use (Base Load)	**5,170,000**	**(scf/h)**
Max Fuel use (with Power Augmentation)	**6,100,000**	**(scf/h)**

(b)

Gross Capacity (MW)		
Unit	**Base load**	**Power Augmentation**
CTG 1	255	255
CTG 2	255	255
STG 1	135	186
STG 2	135	186
Total	**780**	**882**

Site conditions		
Average temperature	55	F
Barometric pressure	14.328	psia
Relative humidity	60	%

(c)

Unit	**Base Load**		**Power Augmentation**	
	Electrical Loads (KW)	**Electrical Losses (KW)**	**Electrical Loads (KW)**	**Electrical Losses (KW)**
CTG-1	255000		255000	
CTG-2	255000		255000	
STG-1	135000		186000	
STG-2	135000		186000	
AIR COMPRESSORS		180		180
CLOSED CYCLE COOLING WATER PUMPS		600		600
BOILER FEEDWATER PUMPS		5600		6500

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)

CONDENSATE PUMPS		600		600
DEMIN WATER TRANSFER PUMPS		36		36
CONDENSER AIR EXTRACTION		150		150
CIRC WATER PUMPS		3200		3200
COOLING TOWER FANS		2400		2400
SERVICE WATER PUMPS		36		36
RAW WATER PUMPs		150		150
Water treatment and chemical feed		800		800
Gas and steam turbine auxiliaries		1600		1600
Economizer recirculation pumps		150		150
HVAC		400		400
DC power supply and UPS		100		100
lighting		200		200
Miscellaneous Controls& Small Loads		700		700
GSU transformer losses		2700		3100
Auxiliary Transformer losses		400		440
Net Electrical Output	**760000**	-	**861000**	-

(d)

Alternate Fuel	N.A.

(e).1

Gross CO2 emission in 30 years: Base Load		
Statutory Life of Plant	30	years
Annual average hours of operation	8,760	h
Heat input (HHV)	5,050	MM BTU/h
Emissions		
CO2 per hour (base load)	292	tons/h
CO2 per year (base load)	2.56E+06	tons/year
CO2 in 30 years (base load)	**7.67E+07**	**tons**

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)	
(e).2	

Gross CO2 emission in 30 years: Base Load with Power Augmentation		
Power Plant Operating on Base Load (A)		
Statutory Life of Plant	30	years
Annual average hours of operation	5,760	h
Heat input (HHV)	5,050	MM BTU/h
Emissions		
CO2 per hour (base load)	292	tons/h
CO2 per year (base load)	1.68E+06	tons/year
CO2 in 30 years (base load)	**5.04E+07**	tons
Power Plant Operating with Power Augmentation (B)		
Statutory Life of Plant	30	years
Annual average hours of operation	3,000	h
Heat input (HHV)	5,950	MM BTU/h
Emissions		
CO2 per hour (with power augmentation)	344	tons/h
CO2 per year (with power augmentation)	1.03E+06	tons/year
CO2 in 30 years (with power augmentation)	**3.10E+07**	tons
Gross CO2 emission in 30 years (Total = A+B)		
Statutory Life of Plant	30	years
Annual average hours of operation	8,760	h
Emissions		
Total CO2 per year	**2.71E+06**	**tons/year**
Total CO2 in 30 years	**8.14E+07**	**tons**

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)			
(f)	**Gross CO2 rate (base load)**		
	CO2 per hour	292	tons/h
		584,000	lb/h
	Net Electric Power	760	MWh
	CO2/kw-h	**0.768**	**lb CO2/kWh**
	Gross CO2 rate (power augmentation)		
	CO2 per hour	344	tons/h
		688,600	lb/h
	Net Electric Power	861	MWh
	CO2/kw-h	**0.800**	**lb CO2/kWh**
(g)	**Excess of CO2 on base load (A)**		
	CO2 emission rate	0.768	lb CO2/kWh
	Standard	0.675	lb CO2/kWh
	Excess of CO2 emission (rate)	0.093	lb CO2/kWh
	Excess of CO2 emission (hour)	35.3	tons CO2/h
	Excess of CO2 emission (year)	2.04E+05	tons CO2/year
	Excess of CO2 emission for 30 years	6.11E+06	tons CO2
	Excess of CO2 with power augmentation (B)		
	CO2 emission rate	0.800	lb CO2/kWh
	Standard	0.675	lb CO2/kWh
	Excess of CO2 emission (rate)	0.125	lb CO2/kWh
	Excess of CO2 emission (hour)	53.8	tons CO2/h
	Excess of CO2 emission (year)	1.61E+05	tons CO2/year
	Excess of CO2 emission for 30 years	4.84E+06	tons CO2

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)			
	Excess of CO2 (Total=A+B)		
	Excess of CO2 emission (year)	**3.65E+05**	**tons CO2/year**
	Excess of CO2 emission for 30 years	**1.09E+07**	**tons CO2**
(h)	**Excess CO2 rate (base load)**	**0.093**	**lb CO2/kWh**
	Excess CO2 rate (power augmentation)	**0.125**	**lb CO2/kWh**
(i)	**Site conditions**		
	Average temperture	55	F
	Barometric pressure	14.328	psia
	Relative humidity	60	%
(j)	**Site conditions**		
	Average temperture	55	F
	Barometric pressure	14.328	psia
	Relative humidity	60	%
(k) (i)	**Fuel Input: natural gas (HHV)**		
	Base Load		
	Fuel input	5,050	MM BTU/h
	Annual average hours of operation	5,760	h
	Power Augmentation		
	Fuel input	5,950	MM BTU/h
	Annual average hours of operation	3,000	h
	Total fuel input	**4.69E+07**	**MM BTU/year**

Table Y-3 CO2 Emissions Standard Compliance

OAR 345-021-0010(1)(y)			
(l)	**Heat rate and Capacity**		
	Heat rate (base load)	**6,645**	**BTU/kWh**
	Heat rate (power augmentation)	**6,910**	**BTU/kWh**
(m)	Non Generating Facility	N.A.	
(n)	Cogeneration to lower CO2 emissions	N.A.	
(o)	Offset CO2 emissions	N.A.	
(p)	**(ii) Amount of CO2 reduction**	**1.09E+07**	**tons CO2**

Table Y-4 Carbon Dioxide Emission Factor Calculations

Case	Base Load	Power Augmentation
General Information		
CTG Model	MHI-501G1	MHI-501G1
CTG Fuel Type	Natural Gas	Natural Gas
CTG Load	100%	100%
CTG Inlet Air Cooling	Off	Off
CTG Steam/Water Injection	No	No
Ambient Temperature, F	55	55
HRSG Duct Firing	Unfired	Fired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.80	0.80
Calculations		
Gross CTG Output, MW each unit	254,940	254,940
Gross CTG Heat Rate, Btu/kWh (LHV)	8,879	8,879
Gross CTG Heat Rate, Btu/kWh (HHV)	9,900	9,900
CTG Fuel LHV, Btu/lb	20,521	20,521
CTG Fuel HHV, Btu/lb	22,880	22,880
CTG Heat Input, MMBtu/h LHV (2 CTGs)	4530	4530
CTG Heat Input, MMBtu/h HHV (2 CTGs)	5050	5050
Total CTG Fuel, lb/h (per CTG)	110,310	110,310
Duct Burner Fuel Flow, lb/h (per HRSG)	0	19,790
Duct Burner Heat Input, MMBtu/h LHV (2 HRSGs)	0	812.22
Duct Burner Heat Input MMBtu/h HHV (2 HRSGs)	0	905.59
Fuel Density, lb/scf	0.043	0.043
Total Fuel Flow, million scf/h (2 CTG - HRSG trains)	5.17	6.10
Total Fuel input MMBtu/h LHV (2 CTG-HRSG trains)	4530	5340
Total Fuel input MMBtu/h HHV (2 CTG-HRSG trains)	5050	5960
Carbon Weight % in the Fuel	72.18	72.18
Carbon, lb/h per unit	79,618	93,901
Carbon, mol/h per unit	6,629	7,819
Carbon Dioxide, mol/h per unit	6,629	7,819
Carbon Dioxide, lb/h per unit	292,000	344,000
Carbon Dioxide, ton/h per unit	146	172
Gross Plant Output MW both Units	760	861
Carbon Dioxide, lb CO2/kWh (LHV)	0.768	0.799

Table Y-4 Carbon Dioxide Emission Factor Calculations

Notes

1. All values are preliminary and no guarantees apply.
2. The CO_2 emissions estimates shown in the table above are per stack/unit and a single CTG - HRSG train in operation.
3. The Gross Plant Output estimates are based on assumed technology and performance.

EXHIBIT Z

COOLING TOWER IMPACTS
OAR 345-021-0010(1)(z)

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Z.1 INTRODUCTION

OAR 345-021-0010(1)(z) *The application for site certificate for the proposed project must contain information about the cooling tower plume, if the proposed facility has an evaporative cooling tower.*

Response: Portland General Electric Company (PGE) is proposing to construct and operate a power generation facility near the Carty Reservoir, located approximately 13 miles southwest of Boardman, Oregon. Electric power production would generate excess heat, and cooling towers would be employed to control heat dissipation.

This exhibit provides information regarding impacts of the cooling tower plume resulting from operation of the proposed PGE Carty Generating Station.

Based on a computer modeling analysis performed for the facility's cooling towers using preliminary engineering data and historical meteorological data, no potential significant adverse impacts warranting mitigation from cooling tower operation are expected.

Z.2 SIZE AND FREQUENCY OF OCCURRENCE OF VISIBLE PLUME

OAR 345-021-0010(1)(z)(A) *Exhibit Z shall include the predicted size and frequency of occurrence of a visible plume and an assessment of its visual impact.*

Response: For the PGE Carty Generating Station, mechanical-draft "wet" cooling towers would be utilized. It is expected that two blocks of power will be built, with each block expected to have a cooling tower arranged in a single housing with seven cells. Final selection of the combustion turbine and steam turbine equipment would determine the actual cooling tower arrangement and number of cells. Mechanical-draft cooling towers use fans to force air into the cooling tower and through a fine spray of heated water, where evaporation cools the water stream and transfers heat to the air. The warm, moist air exhausts vertically, dispelling excess heat. When this warm, moist exhaust air comes into contact with the cooler ambient atmosphere, the water vapor condenses into fine water drops, creating a visible "steam" plume. As the plume mixes with more ambient air, the drops eventually re-evaporate and the plume dissipates. The length of the visible plume depends on the ambient air mixing rate and the amount of water vapor already in the ambient air (e.g., relative humidity). During periods of low temperature and high humidity, vapor plumes from the cooling towers and exhaust stacks may be visible. These plumes are most likely to be visible during the winter months. In general, if the air is calm (low mixing) and the relative humidity is high, plumes will tend to be persistent. Vapor plumes may also be visible during nighttime hours when the energy facility is illuminated. Fogging is assumed to occur when the visible plume reaches the ground, and ice formation occurs when the visible plume reaches the ground under freezing conditions.

The Carty Generating Station is currently expected to have one cooling tower system per block, with each cooling tower housing containing approximately seven cells. For this analysis, the Seasonal/Annual Cooling Tower Impact (SACTI) model was used using the methodology described under requirement OAR 345-021-0010(1)(z)(E), in section Z.6 of this document. This model was created by Argonne National Laboratories in the mid-1980s in order to better evaluate impacts associated with water vapor plumes emitted from cooling towers.

Z.2.1 Model Conservatism and Accuracy

The SACTI model provides a conservative (over-predictive) analysis of cooling tower operations and their behavior under ambient meteorological conditions. The parameters used to define cooling tower operations are based on design operating scenarios and, therefore, represent worst-case conditions. Under normal circumstances, equipment such as cooling towers are operated at some fraction of its design rating so emissions from the towers would most often be lower than the model predicts.

The SACTI model uses hourly meteorological data and mixing height data to establish environmental conditions. There are a limited number of stations from which to get meteorological data for the modeling analysis. In the case of the Carty Generating Station, the data were obtained from a station located at the Umatilla Army Depot, approximately 21 miles northeast of Carty Reservoir.

The SACTI model was run using meteorological data from 1995 to 1999 to calculate the potential annual plume drift patterns around the facility and the potential incidence of fogging and ice formation.

Z.2.2 Plume Length

Table Z-1 shows the frequency of time (in percent) that the model predicted that a visible plume would have a particular length, expressed in terms of downwind distance for any wind direction. The data indicate a less than 50% frequency of plume visibility at 400 meters or greater distance downwind from the facility. Table Z-1 shows seasonal and annual data, where the SACTI model predicts that a visible plume could extend up to 300 meters from the cooling towers 53% of the time.

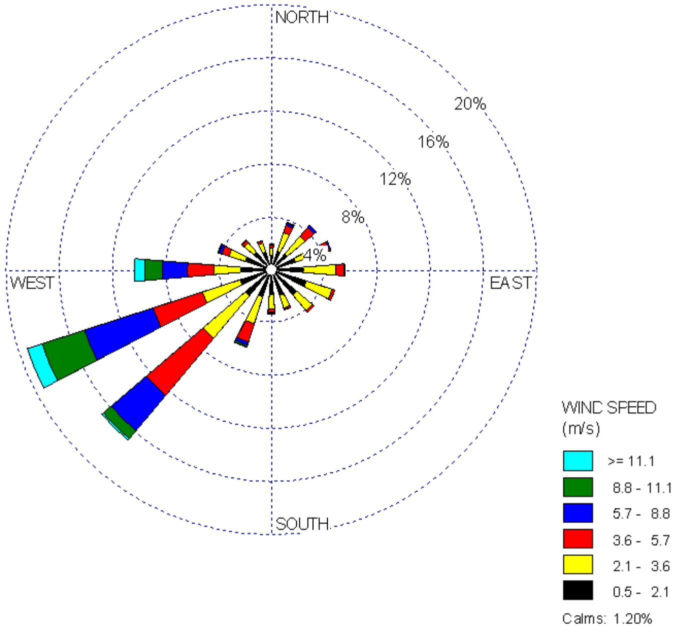
Table Z-1 Predicted Frequency of the Length of Visible Plume (in percent)

Distance (meters)	Seasons		
	Nov–April	May-Oct	Annual
100	99.82	100.00	100.00
200	94.53	50.79	72.59
300	83.44	28.71	55.98
400	66.15	14.92	40.45
500	56.96	10.87	33.83
600	52.09	9.19	30.57
700	43.89	6.51	25.14
800	39.73	5.54	22.58
900	38.85	5.39	22.06
1000	34.82	4.37	19.54
1100	34.82	4.37	19.54
1200	33.75	4.21	18.93
1300	33.75	4.21	18.93
1400	33.75	4.21	18.93
1500	33.75	4.21	18.93
1600	33.75	4.21	18.93
1700	33.75	4.21	18.93
1800	33.75	4.21	18.93
1900	33.75	4.21	18.93
2000	33.75	4.21	18.93
2100	33.75	4.21	18.93
2200	33.75	4.21	18.93
2300	33.75	4.21	18.93
2400	28.04	4.00	15.98
2500	26.70	3.93	15.28

Z.2.3 Plume Heading

The data in Table Z-1 are directional; and on any given day, the plume could extend in one general direction to the length indicated. The plume is expected to align with the prevailing winds in the area. Therefore, Figure Z-1 shows the wind rose for the area, considering meteorological records from 1995 to 1999. Accordingly, SACTI's output for ground fogging is shown in Figure Z-2, which reflects the influence of the prevailing winds at the project site to the plume direction.

Figure Z-1 Wind Rose at Carty Generating Station from 1995 to 1999 (wind blowing from)



Z.2.4 Visual Impact

The Carty Generating Station would be built in an area located approximately 13 miles southwest of Boardman, Oregon, near the existing Boardman Plant in Morrow County, Oregon. The landscape is relatively flat, which allows the existing power plant to be seen from long distances, especially the principal stack.

The plume from the cooling tower of the Carty Generating Station may be visible from existing public roads and Highway Interstate 84, from the Boardman airport, from agricultural facilities, from private residences, and from the existing power plant.

At night, the cooling tower plume may not be visible, depending on clarity and cloud cover. The period of maximum visual impact would be during clear, cold, and calm days. Based on meteorological records, cooler ambient temperatures that would tend to promote formation of a visual plume occur typically during the period from November through March, but it should also be noted that calm wind conditions registered during that period are rare (1.55 %). Cloud cover is often present in the winter months, which would tend to obscure the cooling tower plume and lessen its visual impact.

Therefore, the plume generated by the cooling towers is not expected to generate significant visual impact due to ambient weather conditions and cloud cover.

Z.3 LOCATIONS AND FREQUENCY OF OCCURRENCE OF ICE FORMATION AND GROUND LEVEL FOGGING

OAR 345-021-0010(1)(z)(B) *Exhibit Z shall include the predicted locations and frequency of occurrence of ice formation on surfaces and ground level fogging and an assessment of significant potential adverse impacts, including, but not limited to, traffic hazards on public roads.*

Response: Ice formation is defined by the *Glossary of Meteorology* (American Meteorological Society – 1980) as "In general, any deposit or coating of ice on an object, caused by the impingement and freezing of liquid (usually supercooled) hydrometers."

Fogging would occur when the visible cooling tower plume reaches the ground, and ice formation would occur when the visible plume reaches the ground under freezing conditions.

OAR 345-021-0010(1)(z)(B) specifically requires that the applicant provide the predicted locations and frequency of occurrence of ice formation for an assessment of significant potential adverse impacts, including, but not limited to, traffic hazards on public roads. Since the definition of ice formation above refers to "impingement and freezing of liquid hydrometers," PGE pursued an analysis of the Carty Generating Station cooling tower plume and its predicted impact of ice formation on nearby public roads.

The SACTI model was used for predicting ice formation from cooling towers. This model uses actual meteorological data (five years) to conservatively predict the occurrence of ice formation and other parameters. This prediction is based on the assumption that when a visible plume from a cooling tower extends to the ground surface under freezing conditions, a potential traffic hazard may be created on nearby roadways. SACTI calculates fogging and ice formation by the number of hours during which the visible plume reaches the ground.

Z.3.1 Ground Level Fogging

Table Z-2 and Figure Z-2 display the total number of hours that fogging could have occurred under Umatilla meteorological and mixing conditions encountered between 1995 and 1999. The magnitude of these data is assumed to be conservatively representative of conditions that could be expected in future years near the facility. The lateral direction in which fogging would likely occur is assumed to be aligned with the local prevailing wind directions from the southwest and east, represented in Figure Z-1. Potential fogging impacts would be constrained to Carty Reservoir and the Boardman Power Plant, in the opposite direction of nearby farms to the west.

Table Z-2 Projected Average Annual Hours of Ground Fogging

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Total
100	5.2	11.2	6.4	3	1.4	0	0	0.8	1.5	2	11.9	67.8	37.6	15.6	0	0.7	165.1
200	1.7	22	3	5.5	0.3	0	0	0.7	2	0.9	16.4	200.5	41.8	15.5	0	0.4	310.8
300	1	16.1	1.5	4.1	0	0	0	0	1.5	0	11.5	134.7	32.9	2.1	0	0.3	205.6
400	1	11	0.9	3	0	0	0	0	0	0	5.6	55.2	7.3	0.7	0	0.1	84.8
500	1	11	1	3	0	0	0	0	0	0	4	27.6	6	0	0	0	53.6
600	1	11.1	1	3	0	0	0	0	0	0	4	26.1	6	0	0	0	52.2
700	0.5	6.5	0.7	1.5	0	0	0	0	0	0	2.7	18.8	5.6	0	0	0	36.3
800	0.5	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3.7	0	0	0	26.2
900	0.5	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25.5
1000	0.5	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25.5
1100	0.5	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25.5
1200	0.4	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25.4
1300	0	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25
1400	0	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25
1500	0	5.5	0.5	1.5	0	0	0	0	0	0	2	12.5	3	0	0	0	25
1600	0	4.1	0.4	1.1	0	0	0	0	0	0	1.5	9.3	3	0	0	0	19.4

Z.3.2 Roadways

The area over land potentially affected by fogging would be limited to an area northeast and, to a lesser extent, to the southwest of Carty Generating Station's cooling towers. Furthermore, the total predicted duration of fogging at 500 meters from the cooling towers is expected to be less than 25 hours per year. Tower Road is a service road located in this area that leads to the existing Boardman Plant. The service roadway configuration may be changed as a part of this project, but it is expected that there will be little additional opportunity for fogging to interfere with any other roadways. The traffic hazard due to fogging of roadways is expected to be negligible, and no significant potential adverse impacts due to fogging are anticipated.

Z.3.3 Ice Formation Impacts

Table Z-3 and Figure Z-3 display the total number of hours that ice formation could have occurred under Umatilla meteorological and mixing conditions encountered between 1995 and 1999. As with fogging, the magnitude of these data are assumed to be conservatively representative of conditions that could be expected in future years near the facility. The direction in which ice formation would likely occur is assumed to be aligned with the winds above 7.5 meters/sec that are accompanied with temperatures below -5° Celsius, to the southwest of the Carty Generating Station.

The horizontal and temporal extent of ice formation due to the PGE Carty Generating Station cooling tower plume would be quite limited, occurring only toward the south and southwest for a period of time of 1 hour or less at 500 meters. In addition, there are no public roads within the

500 meters and few service roads in the area. As Figure Z-3 indicates, the duration and extent of ice formation are very limited. The traffic hazard due to ice formation on roadways is expected to be negligible, and no potential significant adverse impacts are anticipated.

Table Z-3 Projected Average Annual Hours of Ice Formation

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Total
100	2.1	4.6	1.9	0.2	0	0	0	0	0	0	0	0	0	0	0	0.7	9.5
200	1	9.1	2	0	0	0	0	0	0	0	0	0	0	0	0	0.4	12.6
300	1	6.6	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0.3	9.3
400	1	4	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0.1	5.9
500	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
600	1	4.1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6.1
700	0.5	3	0.7	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2
800	0.5	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
900	0.5	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1000	0.5	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1100	0.5	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1200	0.4	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2.9
1300	0	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5
1400	0	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5
1500	0	2	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5
1600	0	1.5	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9

Z.4 LOCATIONS AND RATES OF DEPOSITION OF SOLIDS RELEASED FROM THE COOLING TOWER

OAR-345-021-0010(1)(z)(C) *Exhibit Z shall include the predicted locations and rates of deposition of solids released from the cooling tower (cooling tower drift) and an assessment of significant potential adverse impacts to soils, vegetation and other land uses*

<u>Response:</u>

Z.4.1 Significant Potential Adverse Impacts to Soils, Vegetation, and Other Land Uses

This section addresses the significant potential adverse impacts to soils, vegetation, and other land uses that could result from the deposition of solids released from the cooling tower. Based on modeling with SACTI, the predicted deposition rates for salts (sodium, potassium, and magnesium); total dissolved solids; arsenic; cadmium; and chromium are shown in Figures Z-4 through Z-8, respectively, and in Tables Z-4 through, Z-8, respectively. Modeling results show that the greatest salt deposition rates occur within 200 meters of the cooling tower (Figure Z-4 and Table Z-4). From 200 to 600 meters from the source, deposition rates decrease rapidly, such that the deposition area depicted in the figures lies within the Site Boundary. Beyond this boundary, deposition rates will be less than 50 kilograms per square kilometer per month (kg/km^2-mo). Westward from the project, the closest irrigation circles are 700 meters away, where the predicted deposition rates were lower than 6 kg/km^2-mo. Deposition rates for total dissolved solids, arsenic, cadmium, and chromium show a similar distribution.

Table Z-4 Projected Average Salt Deposition Rate [kg/km^2-mo]

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Average
100	1016.6	1102.2	1148.4	2061.1	1253.8	994.3	827.1	1418.6	1722.6	4287.1	6162.8	6118.4	1085.8	724.9	611.3	1016.6	1962.3
200	90.9	102.1	109.9	173.4	124.8	100.7	83.0	139.2	178.7	442.1	590.5	428.6	98.2	65.1	54.7	90.9	178.7
300	25.1	28.1	33.7	63.6	41.0	32.6	26.6	34.1	54.3	125.1	142.0	87.4	23.9	16.3	14.3	25.1	47.8
400	8.2	8.8	10.2	23.0	12.8	10.6	8.7	16.7	17.4	38.1	41.9	36.9	8.8	5.6	4.8	8.2	16.3
500	4.7	5.0	5.9	12.0	7.4	6.0	4.8	10.5	9.2	19.9	21.8	23.4	4.6	3.0	2.7	4.7	9.1
600	3.2	3.5	4.3	7.1	5.5	4.4	3.6	6.4	7.3	16.4	17.9	14.1	3.3	2.3	2.0	3.2	6.5
700	2.3	2.6	3.3	5.3	4.2	3.3	2.7	3.9	5.4	12.0	13.1	8.6	2.4	1.7	1.5	2.3	4.6
800	1.8	2.0	2.5	4.3	3.2	2.5	2.1	3.1	4.2	9.3	9.9	6.6	1.8	1.3	1.1	1.8	3.6
900	1.4	1.6	2.1	3.9	2.6	2.0	1.7	2.5	3.3	7.5	8.0	5.5	1.4	1.0	0.9	1.4	2.9
1000	1.2	1.3	1.6	3.2	2.1	1.6	1.3	2.0	2.7	6.0	6.5	4.4	1.1	0.8	0.7	1.2	2.4
1100	1.0	1.1	1.4	2.6	1.8	1.4	1.1	1.5	2.2	5.0	5.4	3.2	0.9	0.7	0.6	1.0	1.9
1200	0.8	0.9	1.1	2.1	1.4	1.1	0.9	1.3	1.8	4.0	4.5	2.7	0.8	0.6	0.5	0.8	1.6
1300	0.7	0.8	1.0	1.9	1.3	1.0	0.8	0.9	1.6	3.6	3.9	1.9	0.7	0.5	0.5	0.7	1.4
1400	0.6	0.7	0.8	1.7	1.1	0.9	0.7	0.7	1.4	3.1	3.4	1.5	0.6	0.4	0.4	0.6	1.2
1500	0.5	0.6	0.7	1.4	0.9	0.7	0.6	0.6	1.2	2.7	2.9	1.3	0.5	0.4	0.3	0.5	1.0
1600	0.5	0.5	0.6	1.0	0.8	0.6	0.5	0.6	1.1	2.4	2.6	1.2	0.5	0.3	0.3	0.5	0.9
1700	0.4	0.4	0.5	0.8	0.6	0.5	0.4	0.5	0.9	2.0	2.1	1.0	0.4	0.3	0.2	0.4	0.7
1800	0.3	0.4	0.4	0.7	0.6	0.4	0.4	0.5	0.8	1.7	1.9	0.9	0.4	0.2	0.2	0.3	0.6
1900	0.3	0.3	0.4	0.6	0.5	0.4	0.3	0.4	0.7	1.6	1.7	0.9	0.3	0.2	0.2	0.3	0.6
2000	0.3	0.3	0.4	0.6	0.5	0.4	0.3	0.4	0.6	1.5	1.6	0.8	0.3	0.2	0.2	0.3	0.5
2100	0.3	0.3	0.4	0.6	0.4	0.4	0.3	0.3	0.6	1.4	1.5	0.7	0.3	0.2	0.2	0.3	0.5
2200	0.2	0.3	0.3	0.5	0.4	0.3	0.3	0.3	0.5	1.2	1.4	0.6	0.3	0.2	0.2	0.2	0.5
2300	0.2	0.2	0.3	0.5	0.4	0.3	0.2	0.2	0.5	1.1	1.2	0.5	0.2	0.2	0.1	0.2	0.4
2400	0.2	0.2	0.2	0.5	0.3	0.2	0.2	0.2	0.4	0.9	1.0	0.4	0.2	0.1	0.1	0.2	0.3
2500	0.2	0.2	0.2	0.4	0.3	0.2	0.2	0.2	0.4	0.8	0.9	0.3	0.2	0.1	0.1	0.2	0.3
2600	0.1	0.1	0.2	0.4	0.2	0.2	0.1	0.2	0.3	0.7	0.7	0.3	0.1	0.1	0.1	0.1	0.2
2700	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1	0.3	0.6	0.6	0.3	0.1	0.1	0.1	0.1	0.2
2800	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.6	0.6	0.2	0.1	0.1	0.1	0.1	0.2
2900	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.2	0.1	0.1	0.1	0.1	0.2
3000	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.2	0.1	0.1	0.1	0.1	0.1

Note: Average Salt Deposition Rate is shown on Figure Z-4

Table Z-5 Projected Average Deposition Rate of Total Dissolved Solids [kg/km²-mo]

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Average
100	3864.89	4190.62	4366.01	7836.26	4766.90	3780.32	3144.53	5393.30	6549.01	16298.93	23430.49	23261.36	4127.98	2756.16	2323.94	7460.42	3864.89
200	345.49	387.99	417.97	659.32	474.31	382.70	315.42	529.12	679.46	1680.85	2245.05	1629.64	373.52	247.43	208.15	679.58	345.49
300	95.43	106.77	128.07	241.98	155.97	124.09	101.13	129.57	206.59	475.56	539.86	332.37	91.02	61.86	54.18	181.72	95.43
400	31.10	33.58	38.93	87.29	48.55	40.15	33.17	63.45	66.21	144.67	159.36	140.19	33.36	21.14	18.32	61.86	31.10
500	17.95	19.14	22.46	45.73	28.16	22.77	18.23	39.90	34.89	75.83	82.72	89.01	17.63	11.56	10.24	34.73	17.95
600	12.12	13.34	16.29	26.90	20.80	16.88	13.62	24.49	27.72	62.30	67.90	53.65	12.53	8.58	7.49	24.81	12.12
700	8.86	9.87	12.37	20.04	15.85	12.62	10.24	14.97	20.45	45.73	49.64	32.73	8.96	6.30	5.61	17.63	8.86
800	6.67	7.58	9.40	16.38	12.03	9.46	7.83	11.62	15.79	35.17	37.71	25.09	6.83	4.82	4.26	13.56	6.67
900	5.48	6.20	7.83	14.78	9.93	7.74	6.30	9.43	12.72	28.63	30.29	20.77	5.23	3.88	3.35	11.12	5.48
1000	4.38	4.92	6.23	12.12	7.99	6.23	5.04	7.61	10.09	22.89	24.62	16.63	4.20	3.13	2.72	8.96	4.38
1100	3.79	4.13	5.23	9.90	6.80	5.32	4.32	5.64	8.39	19.01	20.58	12.21	3.60	2.66	2.35	7.33	3.79
1200	3.16	3.45	4.29	8.11	5.48	4.32	3.51	4.82	6.80	15.38	17.10	10.40	3.01	2.16	1.94	6.01	3.16
1300	2.79	3.07	3.76	7.20	4.79	3.82	3.07	3.51	6.01	13.56	14.97	7.39	2.72	1.97	1.72	5.14	2.79
1400	2.38	2.63	3.19	6.45	4.07	3.26	2.66	2.76	5.29	11.96	13.03	5.79	2.38	1.69	1.47	4.38	2.38
1500	1.91	2.13	2.66	5.42	3.32	2.63	2.13	2.35	4.51	10.27	11.02	4.89	1.91	1.35	1.16	3.66	1.91
1600	1.75	1.94	2.38	3.95	2.94	2.32	1.88	2.16	4.04	9.27	9.99	4.48	1.72	1.22	1.03	3.26	1.75
1700	1.41	1.53	1.88	2.91	2.38	1.88	1.53	1.91	3.26	7.52	8.14	3.92	1.44	1.03	0.88	2.66	1.41
1800	1.25	1.38	1.66	2.60	2.10	1.66	1.41	1.72	2.91	6.61	7.27	3.57	1.35	0.94	0.78	2.38	1.25
1900	1.16	1.28	1.50	2.41	1.88	1.50	1.25	1.63	2.60	5.95	6.64	3.35	1.25	0.85	0.72	2.19	1.16
2000	1.10	1.19	1.41	2.13	1.75	1.44	1.16	1.50	2.44	5.61	6.17	3.19	1.19	0.81	0.69	2.04	1.10
2100	1.03	1.13	1.35	2.13	1.66	1.38	1.13	1.28	2.32	5.26	5.86	2.63	1.16	0.78	0.66	1.91	1.03
2200	0.94	1.03	1.22	2.07	1.53	1.25	1.00	1.10	2.07	4.67	5.23	2.35	1.03	0.72	0.63	1.72	0.94
2300	0.85	0.91	1.10	2.00	1.35	1.10	0.88	0.91	1.79	4.04	4.51	1.94	0.88	0.63	0.56	1.50	0.85
2400	0.72	0.81	0.94	1.85	1.16	0.94	0.75	0.72	1.53	3.48	3.85	1.44	0.75	0.53	0.47	1.28	0.72
2500	0.60	0.66	0.81	1.69	0.97	0.78	0.63	0.66	1.35	3.04	3.29	1.32	0.63	0.44	0.38	1.10	0.60
2600	0.50	0.56	0.69	1.41	0.81	0.66	0.53	0.60	1.13	2.54	2.66	1.25	0.47	0.34	0.31	0.94	0.50
2700	0.47	0.50	0.63	1.16	0.75	0.56	0.44	0.47	0.97	2.22	2.32	1.00	0.44	0.31	0.28	0.81	0.47
2800	0.47	0.47	0.60	0.88	0.72	0.53	0.44	0.41	0.91	2.13	2.19	0.88	0.41	0.31	0.28	0.75	0.47
2900	0.38	0.41	0.50	0.75	0.56	0.41	0.34	0.38	0.69	1.63	1.69	0.78	0.34	0.25	0.22	0.60	0.38
3000	0.38	0.38	0.47	0.63	0.50	0.38	0.31	0.34	0.63	1.47	1.53	0.75	0.31	0.25	0.22	0.56	0.38

Note: Average Deposition Rate of Total Dissolved Solids is shown on Figure Z-6.

Table Z-6 Projected Average Arsenic Deposition Rate [kg/km^2-mo]

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Average
100	0.0859	0.0931	0.0970	0.1741	0.1059	0.0840	0.0699	0.1199	0.1455	0.3622	0.5207	0.5169	0.0917	0.0612	0.0516	0.1658	0.0859
200	0.0077	0.0086	0.0093	0.0147	0.0105	0.0085	0.0070	0.0118	0.0151	0.0374	0.0499	0.0362	0.0083	0.0055	0.0046	0.0151	0.0077
300	0.0021	0.0024	0.0028	0.0054	0.0035	0.0028	0.0022	0.0029	0.0046	0.0106	0.0120	0.0074	0.0020	0.0014	0.0012	0.0040	0.0021
400	0.0007	0.0007	0.0009	0.0019	0.0011	0.0009	0.0007	0.0014	0.0015	0.0032	0.0035	0.0031	0.0007	0.0005	0.0004	0.0014	0.0007
500	0.0004	0.0004	0.0005	0.0010	0.0006	0.0005	0.0004	0.0009	0.0008	0.0017	0.0018	0.0020	0.0004	0.0003	0.0002	0.0008	0.0004
600	0.0003	0.0003	0.0004	0.0006	0.0005	0.0004	0.0003	0.0005	0.0006	0.0014	0.0015	0.0012	0.0003	0.0002	0.0002	0.0006	0.0003
700	0.0002	0.0002	0.0003	0.0004	0.0004	0.0003	0.0002	0.0003	0.0005	0.0010	0.0011	0.0007	0.0002	0.0001	0.0001	0.0004	0.0002
800	0.0001	0.0002	0.0002	0.0004	0.0003	0.0002	0.0002	0.0003	0.0004	0.0008	0.0008	0.0006	0.0002	0.0001	0.0001	0.0003	0.0001
900	0.0001	0.0001	0.0002	0.0003	0.0002	0.0002	0.0001	0.0002	0.0003	0.0006	0.0007	0.0005	0.0001	0.0001	0.0001	0.0002	0.0001
1000	0.0001	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001	0.0002	0.0002	0.0005	0.0005	0.0004	0.0001	0.0001	0.0001	0.0002	0.0001
1100	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0004	0.0005	0.0003	0.0001	0.0001	0.0001	0.0002	0.0001
1200	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002	0.0003	0.0004	0.0002	0.0001	0.0000	0.0000	0.0001	0.0001
1300	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0003	0.0002	0.0001	0.0000	0.0000	0.0001	0.0001
1400	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0003	0.0001	0.0001	0.0000	0.0000	0.0001	0.0001
1500	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
1600	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0001	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
1700	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0001	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
1800	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
1900	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
2100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
2200	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
2300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2700	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2800	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2900	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Average Arsenic Deposition Rate is shown on Figure Z-7.

Table Z-7 Projected Average Cadmium Deposition Rate [kg/km^2-mo]

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Average
100	0.002073	0.002248	0.002342	0.004203	0.002557	0.002028	0.001687	0.002893	0.003513	0.008743	0.012568	0.012477	0.002214	0.001478	0.001247	0.004002	0.002073
200	0.000185	0.000208	0.000224	0.000354	0.000254	0.000205	0.000169	0.000284	0.000364	0.000902	0.001204	0.000874	0.000200	0.000133	0.000112	0.000365	0.000185
300	0.000051	0.000057	0.000069	0.000130	0.000084	0.000067	0.000054	0.000070	0.000111	0.000255	0.000290	0.000178	0.000049	0.000033	0.000029	0.000097	0.000051
400	0.000017	0.000018	0.000021	0.000047	0.000026	0.000022	0.000018	0.000034	0.000036	0.000078	0.000085	0.000075	0.000018	0.000011	0.000010	0.000033	0.000017
500	0.000010	0.000010	0.000012	0.000025	0.000015	0.000012	0.000010	0.000021	0.000019	0.000041	0.000044	0.000048	0.000009	0.000006	0.000005	0.000019	0.000010
600	0.000007	0.000007	0.000009	0.000014	0.000011	0.000009	0.000007	0.000013	0.000015	0.000033	0.000036	0.000029	0.000007	0.000005	0.000004	0.000013	0.000007
700	0.000005	0.000005	0.000007	0.000011	0.000009	0.000007	0.000005	0.000008	0.000011	0.000025	0.000027	0.000018	0.000005	0.000003	0.000003	0.000009	0.000005
800	0.000004	0.000004	0.000005	0.000009	0.000006	0.000005	0.000004	0.000006	0.000008	0.000019	0.000020	0.000013	0.000004	0.000003	0.000002	0.000007	0.000004
900	0.000003	0.000003	0.000004	0.000008	0.000005	0.000004	0.000003	0.000005	0.000007	0.000015	0.000016	0.000011	0.000003	0.000002	0.000002	0.000006	0.000003
1000	0.000002	0.000003	0.000003	0.000007	0.000004	0.000003	0.000003	0.000004	0.000005	0.000012	0.000013	0.000009	0.000002	0.000002	0.000001	0.000005	0.000002
1100	0.000002	0.000002	0.000003	0.000005	0.000004	0.000003	0.000002	0.000003	0.000005	0.000010	0.000011	0.000007	0.000002	0.000001	0.000001	0.000004	0.000002
1200	0.000002	0.000002	0.000002	0.000004	0.000003	0.000002	0.000002	0.000003	0.000004	0.000008	0.000009	0.000006	0.000002	0.000001	0.000001	0.000003	0.000002
1300	0.000001	0.000002	0.000002	0.000004	0.000003	0.000002	0.000002	0.000002	0.000003	0.000007	0.000008	0.000004	0.000001	0.000001	0.000001	0.000003	0.000001
1400	0.000001	0.000001	0.000002	0.000003	0.000002	0.000002	0.000001	0.000001	0.000003	0.000006	0.000007	0.000003	0.000001	0.000001	0.000001	0.000002	0.000001
1500	0.000001	0.000001	0.000001	0.000003	0.000002	0.000001	0.000001	0.000001	0.000002	0.000006	0.000006	0.000003	0.000001	0.000001	0.000001	0.000002	0.000001
1600	0.000001	0.000001	0.000001	0.000002	0.000002	0.000001	0.000001	0.000001	0.000002	0.000005	0.000005	0.000002	0.000001	0.000001	0.000001	0.000002	0.000001
1700	0.000001	0.000001	0.000001	0.000002	0.000001	0.000001	0.000001	0.000001	0.000002	0.000004	0.000004	0.000002	0.000001	0.000001	0.000000	0.000001	0.000001
1800	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000002	0.000004	0.000004	0.000002	0.000001	0.000001	0.000000	0.000001	0.000001
1900	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000003	0.000004	0.000002	0.000001	0.000000	0.000000	0.000001	0.000001
2000	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000003	0.000003	0.000002	0.000001	0.000000	0.000000	0.000001	0.000001
2100	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000003	0.000003	0.000001	0.000001	0.000000	0.000000	0.000001	0.000001
2200	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000003	0.000003	0.000001	0.000001	0.000000	0.000000	0.000001	0.000001
2300	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000001	0.000002	0.000002	0.000001	0.000000	0.000000	0.000000	0.000001	0.000000
2400	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000001	0.000002	0.000002	0.000001	0.000000	0.000000	0.000000	0.000001	0.000000
2500	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000001	0.000002	0.000002	0.000001	0.000000	0.000000	0.000000	0.000001	0.000000
2600	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000000	0.000001	0.000000
2700	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000
2800	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Note: Average Cadmium Deposition Rate is shown on Figure Z-8

Table Z-8 Projected Average Chromium Deposition Rate [kg/km^2-mo]

Distance (m)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	Average
100	0.029616	0.032112	0.033456	0.060048	0.036528	0.028968	0.024096	0.041328	0.050184	0.124896	0.179544	0.178248	0.031632	0.021120	0.017808	0.057168	0.029616
200	0.002647	0.002973	0.003203	0.005052	0.003635	0.002933	0.002417	0.004055	0.005207	0.012880	0.017203	0.012488	0.002862	0.001896	0.001595	0.005208	0.002647
300	0.000731	0.000818	0.000981	0.001854	0.001195	0.000951	0.000775	0.000993	0.001583	0.003644	0.004137	0.002547	0.000697	0.000474	0.000415	0.001392	0.000731
400	0.000238	0.000257	0.000298	0.000669	0.000372	0.000308	0.000254	0.000486	0.000507	0.001109	0.001221	0.001074	0.000256	0.000162	0.000140	0.000474	0.000238
500	0.000138	0.000147	0.000172	0.000350	0.000216	0.000174	0.000140	0.000306	0.000267	0.000581	0.000634	0.000682	0.000135	0.000089	0.000078	0.000266	0.000138
600	0.000093	0.000102	0.000125	0.000206	0.000159	0.000129	0.000104	0.000188	0.000212	0.000477	0.000520	0.000411	0.000096	0.000066	0.000057	0.000190	0.000093
700	0.000068	0.000076	0.000095	0.000154	0.000121	0.000097	0.000078	0.000115	0.000157	0.000350	0.000380	0.000251	0.000069	0.000048	0.000043	0.000135	0.000068
800	0.000051	0.000058	0.000072	0.000126	0.000092	0.000072	0.000060	0.000089	0.000121	0.000270	0.000289	0.000192	0.000052	0.000037	0.000033	0.000104	0.000051
900	0.000042	0.000048	0.000060	0.000113	0.000076	0.000059	0.000048	0.000072	0.000097	0.000219	0.000232	0.000159	0.000040	0.000030	0.000026	0.000085	0.000042
1000	0.000034	0.000038	0.000048	0.000093	0.000061	0.000048	0.000039	0.000058	0.000077	0.000175	0.000189	0.000127	0.000032	0.000024	0.000021	0.000069	0.000034
1100	0.000029	0.000032	0.000040	0.000076	0.000052	0.000041	0.000033	0.000043	0.000064	0.000146	0.000158	0.000094	0.000028	0.000020	0.000018	0.000056	0.000029
1200	0.000024	0.000026	0.000033	0.000062	0.000042	0.000033	0.000027	0.000037	0.000052	0.000118	0.000131	0.000080	0.000023	0.000017	0.000015	0.000046	0.000024
1300	0.000021	0.000024	0.000029	0.000055	0.000037	0.000029	0.000024	0.000027	0.000046	0.000104	0.000115	0.000057	0.000021	0.000015	0.000013	0.000039	0.000021
1400	0.000018	0.000020	0.000024	0.000049	0.000031	0.000025	0.000020	0.000021	0.000041	0.000092	0.000100	0.000044	0.000018	0.000013	0.000011	0.000034	0.000018
1500	0.000015	0.000016	0.000020	0.000042	0.000025	0.000020	0.000016	0.000018	0.000035	0.000079	0.000084	0.000037	0.000015	0.000010	0.000009	0.000028	0.000015
1600	0.000013	0.000015	0.000018	0.000030	0.000023	0.000018	0.000014	0.000017	0.000031	0.000071	0.000077	0.000034	0.000013	0.000009	0.000008	0.000025	0.000013
1700	0.000011	0.000012	0.000014	0.000022	0.000018	0.000014	0.000012	0.000015	0.000025	0.000058	0.000062	0.000030	0.000011	0.000008	0.000007	0.000020	0.000011
1800	0.000010	0.000011	0.000013	0.000020	0.000016	0.000013	0.000011	0.000013	0.000022	0.000051	0.000056	0.000027	0.000010	0.000007	0.000006	0.000018	0.000010
1900	0.000009	0.000010	0.000012	0.000018	0.000014	0.000012	0.000010	0.000012	0.000020	0.000046	0.000051	0.000026	0.000010	0.000006	0.000006	0.000017	0.000009
2000	0.000008	0.000009	0.000011	0.000016	0.000013	0.000011	0.000009	0.000012	0.000019	0.000043	0.000047	0.000024	0.000009	0.000006	0.000005	0.000016	0.000008
2100	0.000008	0.000009	0.000010	0.000016	0.000013	0.000011	0.000009	0.000010	0.000018	0.000040	0.000045	0.000020	0.000009	0.000006	0.000005	0.000015	0.000008
2200	0.000007	0.000008	0.000009	0.000016	0.000012	0.000010	0.000008	0.000008	0.000016	0.000036	0.000040	0.000018	0.000008	0.000006	0.000005	0.000013	0.000007
2300	0.000006	0.000007	0.000008	0.000015	0.000010	0.000008	0.000007	0.000007	0.000014	0.000031	0.000035	0.000015	0.000007	0.000005	0.000004	0.000012	0.000006
2400	0.000006	0.000006	0.000007	0.000014	0.000009	0.000007	0.000006	0.000006	0.000012	0.000027	0.000030	0.000011	0.000006	0.000004	0.000004	0.000010	0.000006
2500	0.000005	0.000005	0.000006	0.000013	0.000007	0.000006	0.000005	0.000005	0.000010	0.000023	0.000025	0.000010	0.000005	0.000003	0.000003	0.000008	0.000005
2600	0.000004	0.000004	0.000005	0.000011	0.000006	0.000005	0.000004	0.000005	0.000009	0.000019	0.000020	0.000010	0.000004	0.000003	0.000002	0.000007	0.000004
2700	0.000004	0.000004	0.000005	0.000009	0.000006	0.000004	0.000003	0.000004	0.000007	0.000017	0.000018	0.000008	0.000003	0.000002	0.000002	0.000006	0.000004
2800	0.000004	0.000004	0.000005	0.000007	0.000006	0.000004	0.000003	0.000003	0.000007	0.000016	0.000017	0.000007	0.000003	0.000002	0.000002	0.000006	0.000004
2900	0.000003	0.000003	0.000004	0.000006	0.000004	0.000003	0.000003	0.000003	0.000005	0.000012	0.000013	0.000006	0.000003	0.000002	0.000002	0.000005	0.000003
3000	0.000003	0.000003	0.000004	0.000005	0.000004	0.000003	0.000002	0.000003	0.000005	0.000011	0.000012	0.000006	0.000002	0.000002	0.000002	0.000004	0.000003

Note: Average Chromium Deposition Rate is shown on Figure Z-9

Z.4.2 Soils

Within the analysis area, PGE has identified 12 soil series, which contain a total of 26 soil phases. Soil classes were identified using the Natural Resources Conservation Service (NRCS) soil survey program. The NRCS soil survey describes soil conditions in the upper 5 feet and classifies land capability classes and subclasses. A complete description of the soils can be found in Exhibit I and shown in Figure I-1.

As stated previously, the higher rates of salt deposition would occur within the Site Boundary, mainly over soils such as Sagehill fine sandy loam and Royal silt loam, part of which would be covered by structures and artificial surfaces due to the construction of project facilities. Beyond the Site Boundary, salt deposition rates will be below 50 kg/km^2-mo, much lower than the average application rates of nitrogen-based fertilizers to agricultural fields in the Midwest, of approximately 775[1] kg/km^2-month (*Science* 324, 2009).

Z.4.3 Vegetation

Natural vegetation within the project area and beyond the Site Boundary to the north and east has been classified as shrub-steppe. There are agricultural areas currently in production to the west and north of the Site Boundary. Vegetation is described in Exhibit P.

Research into the effects of salt deposition from cooling tower emissions on vegetation has primarily focused on agricultural crops. Research has shown that those crops most sensitive to salt deposition began to show salt stress symptoms above a rate of 836 kg/km^2-month (Pahwa and Shipley 1979). As indicated previously, the predicted deposition rates obtained were lower than 6 kg/km^2-mo outside the Site Boundary, which is 140 times less than the quoted threshold; therefore, no significant impacts to vegetation are anticipated outside of the Site Boundary.

Z.4.4 Land Uses

The predominant land types are classified as cultivated crops or shrub/scrub and the terrain is essentially flat, with minimal slopes. Associated land uses include existing industrial uses (Boardman Plant), farm and agricultural uses (Threemile Canyon Farms), limited natural resource areas, and some wetland features in the vicinity of the site. The proposed facility would be built in an area zoned for general industrial use (MG) and Exclusive Farm Use (EFU) that is already occupied by an existing energy facility. A detailed description of land uses and zoning can be found in Exhibit K.

This project would be located to the north or northwest of the existing Boardman Generating Plant. Existing and proposed facilities have been designed to tolerate the salt loads that may be deposited from the cooling towers. As described previously, the nearest crops would receive rates much below the threshold at which stress symptoms are shown. Therefore, no significant

[1] Application rate of fertilizer based on N in the Midwest U.S.A. were estimated at 93 kg/ha per year, which yields 775 kg/km2-month

impacts to industrial or agricultural activities are anticipated from cooling tower–related salt deposition.

Z.4.4 Reference Regulations

The applicable regulation indicated by the Oregon Department of Agriculture is the OAR 603-059-0100 *Limits of Non Nutritive Constituents*, which limits the level of the metals arsenic, lead, cadmium, nickel, and mercury contained in fertilizers, agricultural amendments, agricultural minerals, and lime products sold or distributed in the State of Oregon. According to the cited regulation, the concentration of metals in the products is limited depending on the amount of other nutrients. Table Z-9 shows the limit for each chemical and a comparison with the maximum concentration expected in the output of the cooling towers.

Table Z-9 Comparison of Output from Cooling Towers with Reference Regulation

Chemical	OAR 603-059-0100 Concentration Limit[a]		Concentration in Cooling Tower Output[b]	
	ppm	g/g-solution	ppm	g/g-solution
Arsenic	54	0.0000540	0.07	0.00000007
Cadmium	45	0.0000450	0.0017	0.0000000017
Mercury	4.2	0.0000042	BDL[c]	
Lead	258	0.0002580	BDL[c]	
Nickel	1050	0.0010500	BDL[c]	

Notes:

a) Limits according to OAR 603-059-0100 (1)(f), applicable when the product has no guaranteed analysis of available phosphate (P2O5) and no guaranteed analysis of a micronutrient.
b) Maximum output concentration, as indicated in Table Z-9.
c) BDL: below detection limit. No trace of these chemicals were found on the intake water (Carty Reservoir)

As indicated in Table Z-9, concentrations in the output water are below the limits indicated in the cited regulations.

Z.5 MEASURES TO REDUCE ADVERSE IMPACTS

OAR 345-021-0010(1)(z)(D) *Exhibit Z shall include any measures Applicant proposes to reduce adverse impacts from the cooling tower plume or drift.*

<u>Response</u>: The Carty Generating Facility cooling towers would be configured with high-efficiency mist eliminators to limit the amount of drift that exhaust vents atop the towers emit, and thus reduce adverse impacts.

Z.6 PLUME ANALYSIS

OAR 345-021-0010(1)(z)(E) *Exhibit Z shall include the assumptions and methods used in the plume analysis*.

Response: The SACTI model was used for this analysis. This model was developed by Argonne National Laboratories for the Electric Power Research Institute in the mid-1980s to better evaluate impacts associated with water vapor plumes emitted from cooling towers. The model is composed of several modules: a meteorological data preprocessor, a plume drift processor, and several post-processing routines. With a full year of meteorological data, the model will determine whether a water vapor plume from a set of cooling towers would cause ground-level fogging and shadowing, and then determine the frequency with which these conditions would occur.

Specifically, the model calculates the following:

- Vapor plume length, height, and radius based on meteorological conditions;
- Frequency tables of plume length, height, and radius as a function of downwind distance and direction;
- Number of hours of plume shadowing as a function of distance and direction;
- The water and salt deposition as a function of distance and direction; and
- Number of hours of ground-level fogging and ice formation as a function of direction and distance.

Because of the potential adverse effects of particulate deposition on plant equipment and possible atmospheric hazards to surrounding areas, such as nearby roadways, this analysis focused on the impacts associated with salt deposition, fogging, and ice formation. In addition, a visibility assessment of the cooling tower plume length was also performed.

Table Z-10 shows the general site parameters used in this SACTI modeling. The cooling tower for each block was assumed to be similar in design and operational characteristics to the existing PGE Port Westward Plant cooling tower, as the heat load on the cooling tower is expected to be similar to the heat load on the Port Westward Plant cooling tower.

Table Z-10 General SACTI Model Input Parameters

Input Parameter Name	Input value	Comments
Site Latitude	45.9269	Decimal degrees
Site Longitude	119.234	Decimal degrees
Zone	8	Pacific time zone
Rural/Urban Switch	1	Rural model
Surface Roughness	1	Cm
Mixing Height Type	2	Twice daily values
Years of Meteorological Data	1995 - 1999	
SAMSON Meteorological Data	Umatilla, Oregon	Umatilla Army Depot
Mixing Height Data	Estimated from surface records	
Number of Representative Wind Directions	3	
Representative Wind Directions	0, 45, 270	degrees east of north
Evaluation Period	Annual, Nov-April, May-Oct	full year evaluated

Table Z-10   General SACTI Model Input Parameters

Input Parameter Name	Input value	Comments
Maximum Downwind Distance	2000	Meters
Salt Concentration	0.005	g salt/g solution
Salt Density	2.17	g/cm^3
Number of Drop Sizes	31	
Drop Size Distribution	see Table Z-7	

The SACTI model was designed to evaluate a single group of cooling towers that have similar characteristics (e.g., type, shape, and exhaust characteristics). The Carty Generating Station cooling tower system is assumed to contain two housings, which are aligned east to west and consist of seven cells per housing. Design parameters are presented in Table Z-11.

Table Z-11   Tower-Specific Design Parameters

Input Parameter Name	Carty Cooling Tower	Units/Description
Number of Tower Housings	2	
Tower Height	15.2	Meters
Tower Housing Length	120.7	Meters
Tower Housing Width	20.2	Meters
Cells per Tower Housing	7	
Total Number of Cells	14	Cells
Single Cell Diameter	10	Meters
Tower Effective Diameter	42.23	Meters
Total Heat Dissipation	678.5	MW
Air Flow Rate	7061.5	Kg/s
Drift Rate	171.36	g/s

The effective diameter of each cell is simply a diameter that corresponds to the combined area of all cells and is given by:

$$D_{eff} = \left[\frac{4}{\pi} A_{tot} \right]^{1/2} = \left[\frac{4}{\pi} \left(N \frac{\pi}{4} D_{cell}^2 \right) \right]^{1/2} = \left[N \; D_{cell}^2 \right]^{1/2} \qquad (1)$$

where A_{tot} is the area of all cells together, N is the number of cells, and D_{cell} is the diameter of a single cell. The model also requires monthly clearness index values and total average daily solar insolation values. For this analysis, values from Portland, Oregon, as reported in Appendix B of the SACTI Users Guide were used, as shown in Table Z-12. The SACTI Users Guide directs use of the closest source of validated information for these two parameters; in this case Portland, Oregon, data was the closest to the project site. Although Boardman is expected to have higher solar insolation and clearness than Portland, the use of values from Portland corresponds to a more adverse condition, which yields model estimates for a plume under less favorable dispersion conditions. Therefore, the use of values for Portland, Oregon, was deemed appropriate for this analysis.

Table Z-12 Monthly Values of Clearness and Average Daily Insolation Values From Portland, Oregon

Month	Clearness	Average Daily Solar Insolation (MJ/m^2)
January	0.34	4.02
February	0.38	6.57
March	0.41	10.05
April	0.45	14.78
May	0.46	17.71
June	0.48	19.8
July	0.58	23.15
August	0.53	18.59
September	0.52	14.36
October	0.43	8.41
November	0.37	4.86
December	0.34	3.47

Table Z-13 shows the drop distribution used in this analysis. Values from Case Study 1 (Table 3-6) in the SACTI User's Manual were used since a drop distribution spectrum was not available.

Table Z-13 Drop Size Distribution

Drop Diameter* (microns)	Mass Fraction	Drop Diameter* (microns)	Mass Fraction
10	0	350	0.0267
20	0.0053	400	0.0233
30	0.0430	450	0.0229
40	0.0741	500	0.0151
50	0.0651	600	0.0433
60	0.0548	700	0.0351
70	0.0351	800	0.0382
90	0.0326	900	0.0273
110	0.0178	1000	0.0171
130	0.0095	1200	0.0319
150	0.0076	1400	0.0332
180	0.0110	1600	0.0643
210	0.0117	1800	0.0221
240	0.0132	2000	0.0307
270	0.0141	2200	0.1540
300	0.0182	-	-

(*): mass fraction of drops with a diameter less than

Cooling towers would use water directly from the Carty Reservoir intake, without any previous treatment. Table Z-14, at the end of this exhibit, shows the water quality of Carty Reservoir from 1981 to 2008. As water is proposed to be recycled "approximately 10 to 12 times in the cooling system before being discharged" (Exhibit V), the intake concentrations would be increased up to 12 times. Thus, deposition modeling utilized increased concentrations to represent maximum feasible emissions for those minerals and metals found in the water quality analysis. Although the current wastewater discharge permit (Water Pollution Control Facility Permit) for the Boardman Plant allows higher metals concentrations in Carty Reservoir, evaluation of the future operation of Carty and continued operation of the Boardman Plant indicate that the maximum values used for dispersion modeling are sufficiently conservative to represent worst-case conditions (i.e., maximum deposition of salts and other solids).

When the SACTI model was developed, techniques that evaluated plumes on an hour-by-hour basis required simplified algorithms to keep the computational times reasonable. The developers of SACTI realized that because of symmetry, a relatively small number of truly distinct plume conditions could be identified for a given site. Thus, the SACTI model does not evaluate plumes on an hour-by-hour basis, but rather evaluates plume behavior, using a more complex plume model, along a selected set of representative wind directions. The representative wind directions are selected based on the geometry of the cooling tower depending on how plumes may merge. For a straight line of cells, representative wind directions would be parallel to the long axis, perpendicular to the long axis, and at 45 degrees (mid-way) to the long axis. For this analysis, the representative wind directions are 270 degrees east of north (wind aligned with the line of cells), 0 degrees (wind perpendicular to the line of cells) and at 45 degrees (mid-way to the line of cells), as shown in Figure Z-9.

For this analysis, five years (1995 to 1999) of hourly surface meteorological data from Umatilla, Oregon, and twice-daily mixing height data estimated from the surface records were used. The surface data were obtained from a station located at the Umatilla Army Depot, while the mixing height file was created using the surface records and the Lakes Environmental's estimator included as a utility in the Rammet View Software.

Z.7 MONITORING

OAR 345-021-0010(1)(z)(F) *Applicant's proposed monitoring program, if any, for cooling tower plume impacts shall be included in Exhibit Z.*

Response: Based on the SACTI computer modeling analysis performed, the physical and visual impacts due to the cooling tower plumes at the proposed PGE project are expected to be minimal and there should be no potential significant adverse impacts. There is no proposed monitoring program for the cooling tower plume impacts because no potential significant adverse impacts are anticipated. Nevertheless, PGE has prepared an overall Revegetation and Noxious Weed Control Plan (Appendix P-4 of Exhibit P), which includes a monitoring program to determine whether construction and operation of the facility will result in significant negative impacts to vegetation. As part of that plan, areas within and surrounding the Energy Facility Site will be monitored and remedial action taken if needed. Therefore, if the deposition of salts, metals, or other minerals were to significantly impact vegetation, that plan would provide a means to monitor and mitigate such impacts.

Z.8 REFERENCES

Pahwa and Shipley. 1979. *A Pilot Study to Detect Vegetation Stress Around a Cooling Tower*. Paper presented at the 1979 Annual Meeting of the Cooling Tower Institute, Houston, Texas.

Seasonal/Annual Cooling Tower Impacts (SACTI) User's Manual: Cooling-Tower-Plume Prediction Code (Revision 1), W.E. Dunn, L. Coke, A.J. Policastro. September, 1987.

Vitousek, P. M. et al *Nutrient Imbalances in Agricultural Development*. Science 324, 1519 (2009).

Rammet View User's Guide, J. Thé, C. Thé and M. Johnson. 2000.

Port Westward Application for Site Certificate, Exhibit Z. 2002.

Table Z-14 Carty Reservoir Annual Water Quality

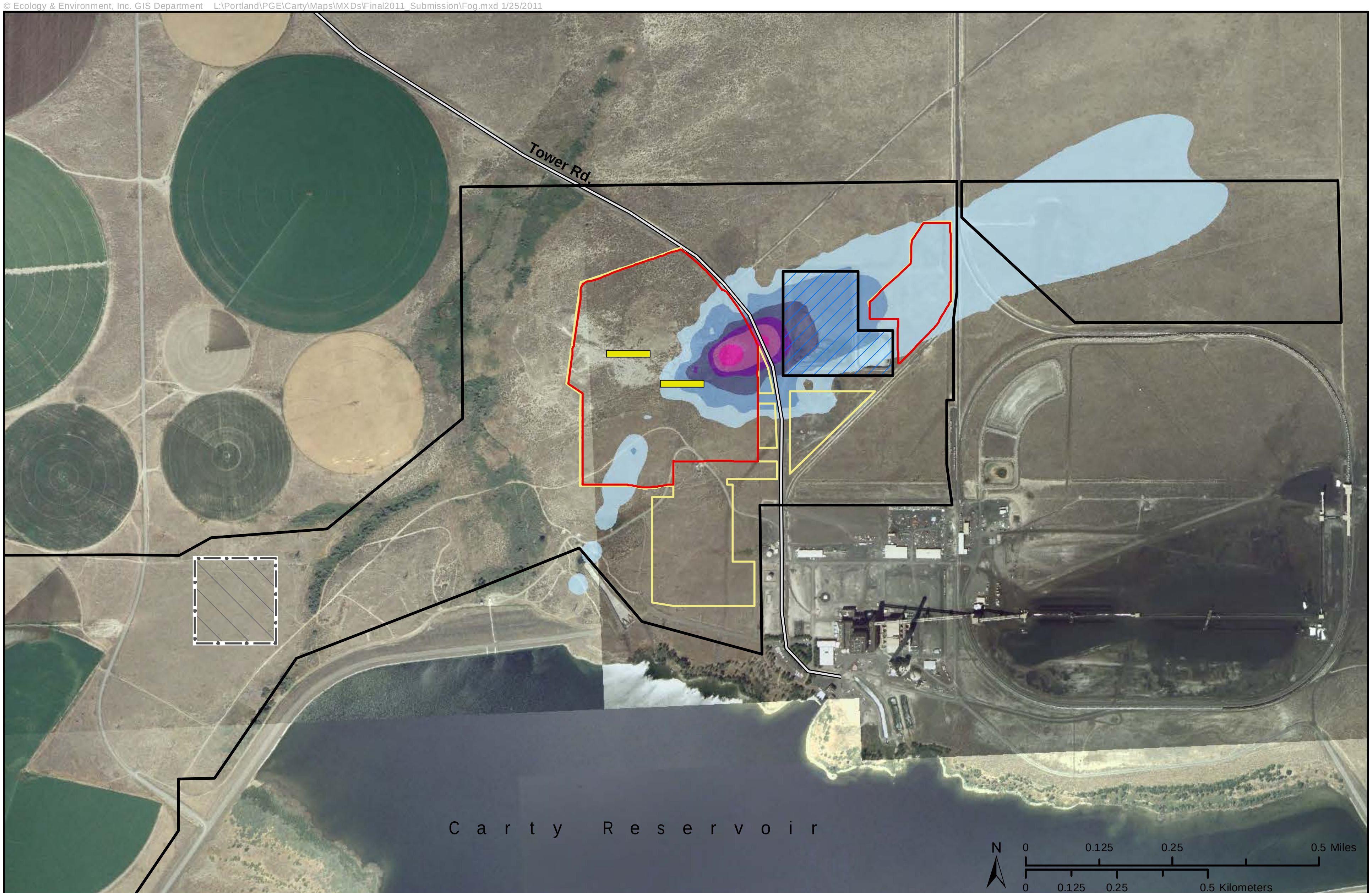
	Concentration(mg/l) +																						
Year	Bicarb.Alk.	Total.Alk.	Chloride	Fluoride	Nitrate	Silica	Sulfate	TDS	SAR	Con-ductivity	pH	Arsenic	Boron	Cadmium	Calcium	Chro-mium	Copper	Iron	Mag-nesium	Mercury	Po-tassium	Sodium	Zinc
1981	110		7	0.3	0.6	2.0	19	158	0.7	240	8.5	0.002	0.1	<0.0001	24	<0.0005	0.006	0.06	10	<0.0002	2.8	15	0.006
1982	111		8	0.3	1.2	1.8	20	169	0.7	276	8.2	0.003	0.2	<0.0001	27	<0.0005	0.006	0.06	9	<0.0002	3.2	16	0.003
1983	112		9	0.3	0.6	3.3	19	171	0.7	263	8.2	0.002	0.2	<0.0001	26	0.0008	0.004	0.08	10	<0.0002	3.3	17	0.003
1984	116		10	0.3	0.3	2.1	19	176	0.8	325	8.5	0.002	0.2	<0.0001	28	<0.0005	0.006	0.07	11	<0.0002	3.5	19	0.005
1985	118		12	0.4	0.2	2.1	22	190	0.8	342	8.5	0.003	0.3	<0.0001	27	<0.0005	0.005	0.07	13	<0.0002	3.9	21	0.005
1986	123		14	0.4	0.3	3.1	23	200	0.9	337	8.7	0.003	0.2	0.0001	24	<0.0005	0.004	0.06	14	<0.0002	3.9	22	0.003
1987	112		14	0.4	0.2	3.1	22	187	0.9	353	8.6	0.004	0.2	0.0001	25	0.0011	0.003	0.16	14	<0.0002	3.8	22	0.015
1988	120		16	0.4	0.2	4.2	22	202	0.9	378	8.2	0.004	0.2	<0.0001	25	0.0006	0.003	0.06	14	<0.0002	4.0	24	0.003
1989	120		15	0.4	0.2	3.3	23	200	0.9	356	8.4	0.003	0.2	<0.0001	26	0.0013	0.004	0.06	13	<0.0002	3.9	23	0.005
1990	117		16	0.4	0.2	1.9	21	192	0.9	370	8.6	0.003	0.2	<0.0001	25	<0.0005	0.004	0.07	13	<0.0002	3.8	23	0.003
1991	115		16	0.4	0.1	2.9	26	208	1.0	373	8.5	0.006	0.1	0.0001	26	0.0010	0.008	0.07	14	<0.0002	3.6	24	0.012
1992	112		15	0.4	0.2	3.4	38	213	1.1	329	8.5	0.004	0.1	<0.0001	25	0.0006	0.009	0.13	15	<0.0002	4.1	28	0.014
1993	111		16	0.4	0.1	2.9	42	225	1.2	357	8.7	0.003	0.1	<0.0001	23	<0.0005	0.009	0.05	15	<0.0002	4.1	30	0.017
1994	120		17	0.4	0.1	2.1	40	228	1.2	353	8.3	0.004	0.1	<0.0001	24	<0.0005	0.009	0.04	16	<0.0002	4.2	31	0.019
1995	119	130	17	0.5	0.1	2.0	39	220	1.2	378	8.9	0.003	0.1	<0.0001	23	<0.0005	0.006	0.05	16	<0.0002	4.1	30	<0.002
1996	123	127	18	0.5	0.1	2.8	39	222	1.2	389	8.6	0.003	0.1	<0.0001	24	<0.0005	0.005	0.06	16	<0.0002	4.3	30	0.007
1997	129	135	19	0.5	0.2	3.7	39	221	1.2	392	8.5	0.003	0.1	<0.0001	24	0.0010	0.005	0.21	16	<0.0002	4.4	30	0.010
1998	129	137	21	0.4	0.5	3.6	44	224	1.2	405	8.5	0.005	0.1	0.0001	25	0.0020	0.005	0.11	18	<0.0002	4.7	32	0.014
1999	135	150	24	0.5	0.2	3.3	47	224	1.3	442	8.3	0.004	0.1	<0.0001	24	0.0020	0.005	0.09	19	<0.0002	5.0	36	<0.001
2000	124	147	25	0.5	0.4	3.2	46	244	1.3	434	8.6	0.004	0.2	<0.0001	23	0.0016	0.005	0.09	19	<0.0002	4.8	36	<0.001
2001	133	148	31	0.6	0.2	3.1	45	261	1.4	444	8.9	0.005	0.1	<0.0001	25	0.0008	0.006	0.11	22	<0.0002	5.3	40	0.012
2002	129	143	27	0.5	0.1	3.8	45	258	1.2	472	8.8	0.004	0.1	0.0001	25	0.0008	0.007	0.16	22	<0.0002	6.5	35	0.002
2003	117	137	25	0.5	0.2	2.5	39	237	1.3	419	8.9	0.004	0.1	0.0001	24	0.0015	0.008	0.11	20	<0.0002	4.7	36	0.003
2004	124	135	23	<0.5	<0.1	2.9	38	235	1.3	380	8.5	0.003	0.1	<0.001	24	<0.001	0.008	0.20	18	<0.0002	4.6	33	<0.005
2005	130	138	22	<0.5	0.1	3.2	39	238	1.2	370	8.5	0.004	0.1	<0.001	23	<0.001	0.007	0.25	18	<0.0002	4.5	32	<0.005
2006	128	129	20	<0.5	<0.1	2.1	34	218	1.1	349	8.3	0.003	0.2	<0.001	22	<0.001	0.005	<0.1	16	<0.0002	3.8	29	<0.005
2007	126	130	20	<0.5	0.2	3.1	36	222	1.1	372	8.7	0.003	0.1	<0.001	24	<0.001	0.008	<0.1	16	<0.0002	4.0	29	<0.005
2008	128	136	18	<0.5	0.1	3.8	35	222	1.1	372	8.7	0.003	0.1	<0.001	25	<0.001	0.007	<0.1	16	<0.0002	3.9	28	<0.005
Site Cert. Limit	**500**	**NA**	**100**	**1.0**	**45**	**NA**	**200**	**1000**	**6.0**	**NA**	**NA**	**1.0**	**0.5**	**0.01**	**500**	**0.05**	**0.1**	**NA**	**250**	**0.01**	**NA**	**1000**	**0.1**
MAX intake (mg/L)	135	150	30.8	0.64	1.2	4.2	47	261	1.42	472	8.9	0.0058	0.3	0.00014	28	0.002	0.009	0.25	22.3	0	6.45	39.9	0.019
MAX intake (g/g-sol)	1.4E-04	1.5E-04	3.1E-05	6.4E-07	1.2E-06	4.2E-06	4.7E-05	2.6E-04	1.4E-06	4.7E-04	8.9E-06	5.8E-09	3.0E-07	1.4E-10	2.8E-05	2.0E-09	9.0E-09	2.5E-07	2.2E-05	0.0E+00	6.5E-06	4.0E-05	1.9E-08
MAX* output (mg/L)	1620	1800	369.6	7.68	14.4	50.4	564	3132	17.04	5664	106.8	0.0696	3.6	0.00168	336	0.024	0.108	3	267.6	0	77.4	478.8	0.228
MAX* output (g/g-sol)	1.6E-03	1.8E-03	3.7E-04	7.7E-06	1.4E-05	5.0E-05	5.6E-04	3.1E-03	1.7E-05	5.7E-03	1.1E-04	7.0E-08	3.6E-06	1.7E-09	3.4E-04	2.4E-08	1.1E-07	3.0E-06	2.7E-04	0.0E+00	7.7E-05	4.8E-04	2.3E-07

Salts intake (Na, K & Mg)	6.87E-05
Salts output (Na, K & Mg)	8.24E-04

Notes:

(+) Annual concentration as an average of monthly samples, based on monitoring conducted by Boardman Plant, as reported to DEQ in annual reports.

(*) Consider 12 times intake concentration due to recirculation, as a worst case scenario



Cooling Tower
Proposed Energy Facility Site
Temporary Construction Areas
Proposed Grassland Switchyard
Site Boundary
Existing Boardman Evaporation Pond
Tower Road

Ground Fogging (hours/year)

10.2 - 20
20.1 - 40
40.1 - 60
60.1 - 80
80.1 - 120
120.1 - 200.5

Figure Z-2
Cooling Tower Projected Average Annual Hours of Ground Fogging
PGE Carty Generating Station
Application for Site Certificate

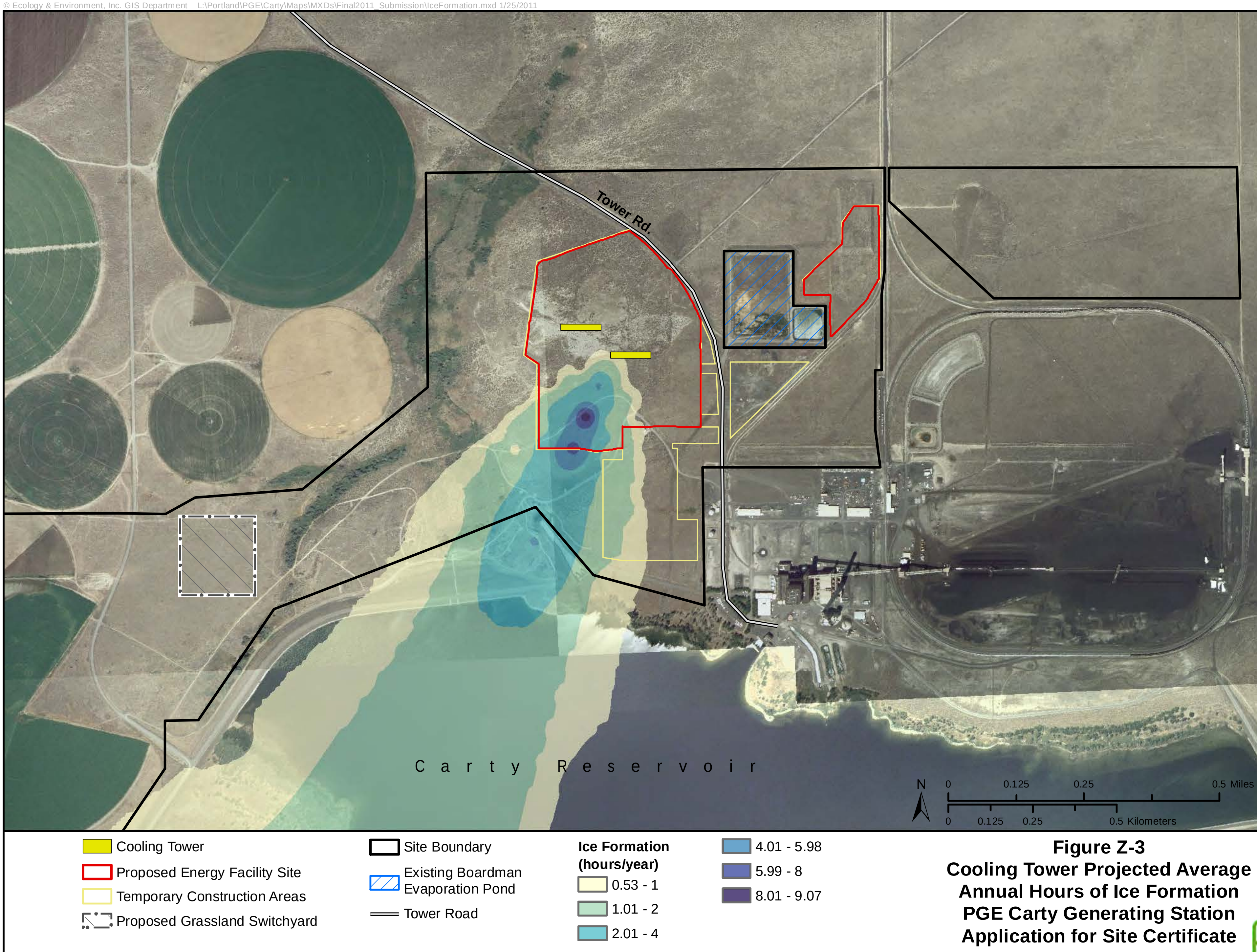
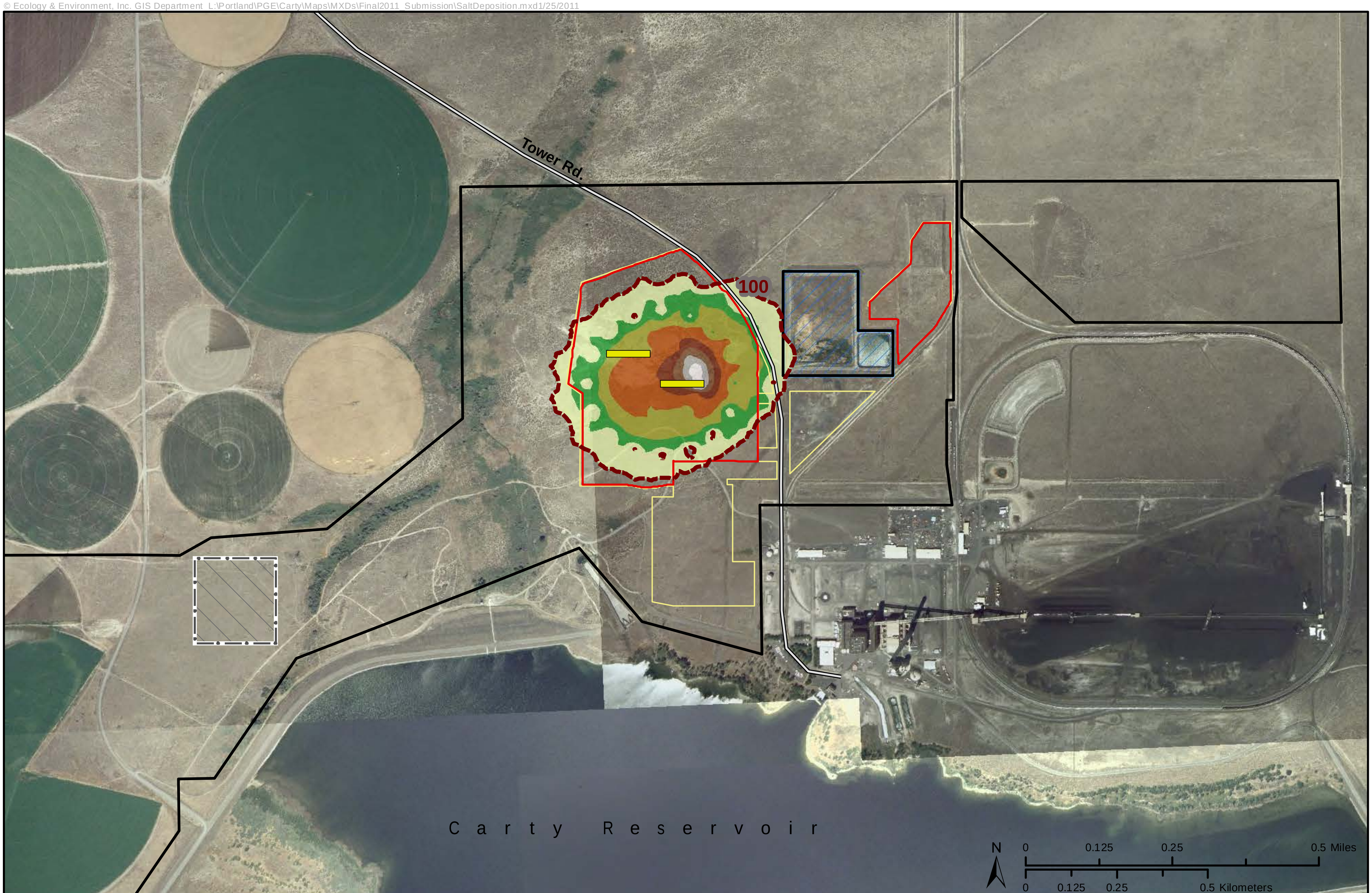


Figure Z-3
Cooling Tower Projected Average Annual Hours of Ice Formation
PGE Carty Generating Station
Application for Site Certificate

Final 2011

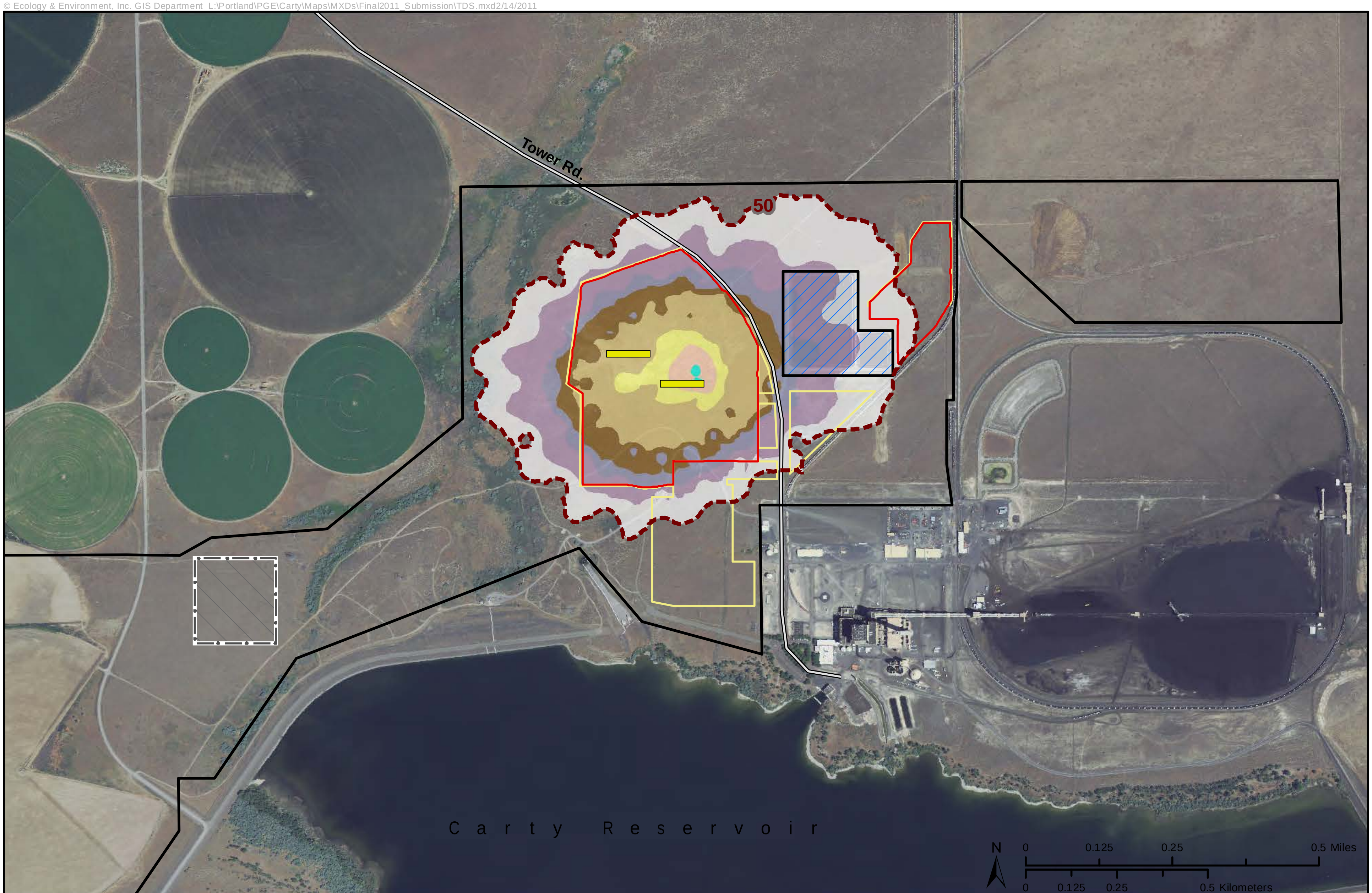


Cooling Tower
Proposed Energy Facility Site
Temporary Construction Areas
Proposed Grassland Switchyard

Site Boundary
Existing Boardman Evaporation Pond
Tower Road

Salt Deposition
kg/(sq.km-month)
Outside < 100
101-250
251-500
501-1,000
1,001-2,000
2,001-3,000
3,001-4,000
4,001-5,000
>5,000

Figure Z-4
Cooling Tower Projected Average Salt Deposition Rate [kg/(sq.km-month)]
PGE Carty Generating Station
Application for Site Certificate

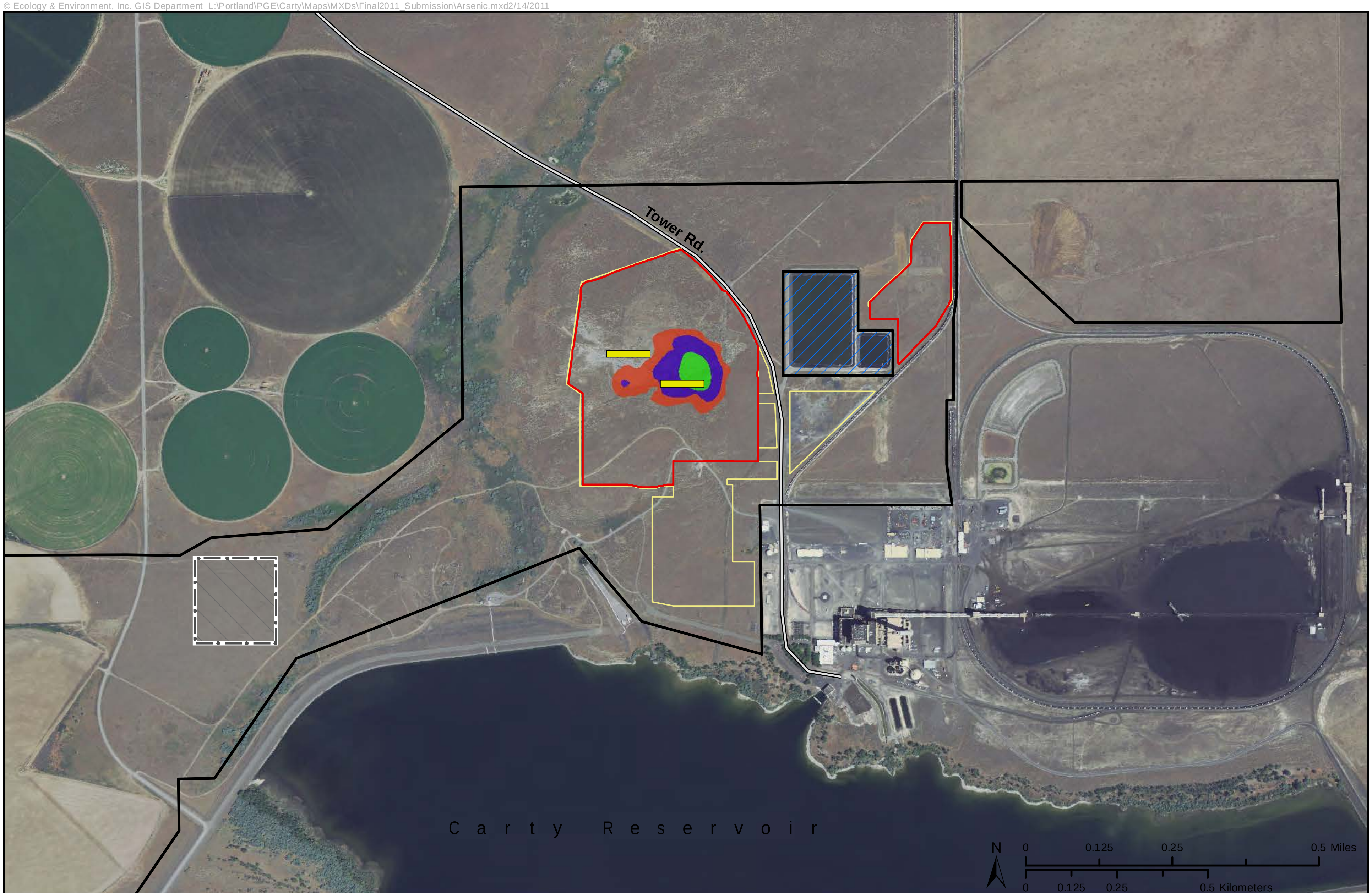


Cooling Tower
Proposed Energy Facility Site
Temporary Construction Areas
Proposed Grassland Switchyard
Site Boundary
Existing Boardman Evaporation Pond
Tower Road

TDS kg/(sq.km-month)
Outside < 50
51-100
101-250
252-500
501-1,000
1,001-5,000
5,001-10,000
10,001-20,000
> 20,000

Figure Z-5
Cooling Tower Projected Average Solid Deposition Rate [kg/(sq.km-month)]
PGE Carty Generating Station
Application for Site Certificate

Final 2011



- Cooling Tower
- Proposed Energy Facility Site
- Temporary Construction Areas
- Proposed Grassland Switchyard
- Site Boundary
- Existing Boardman Evaporation Pond
- Tower Road

Arsenic kg/(sq.km-month)

- 0.01-0.015
- 0.151 - 0.3
- 0.31 - 0.51

Figure Z-6
Cooling Tower Projected Average Arsenic Deposition Rate [kg/(sq.km-month)]
PGE Carty Generating Station
Application for Site Certificate

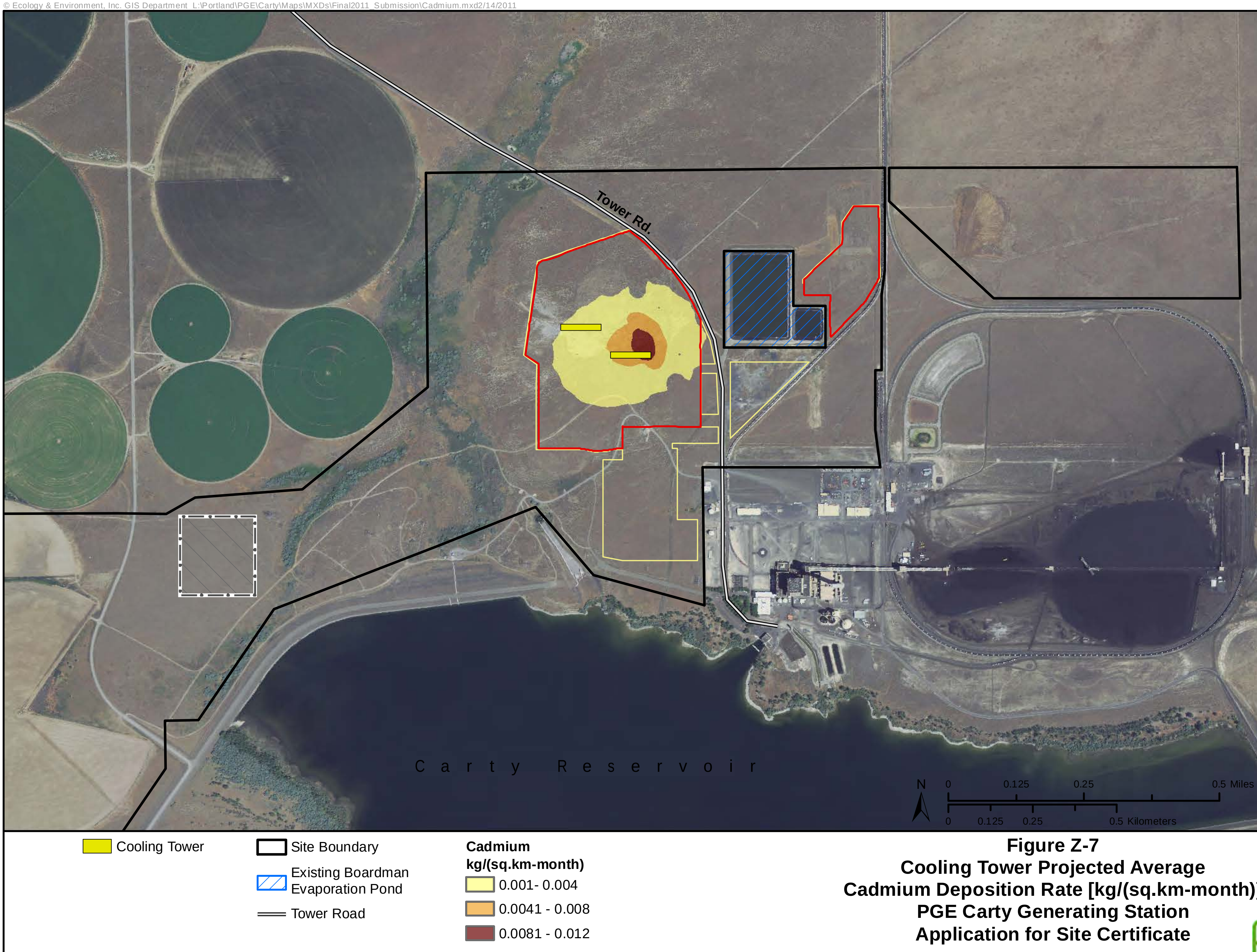
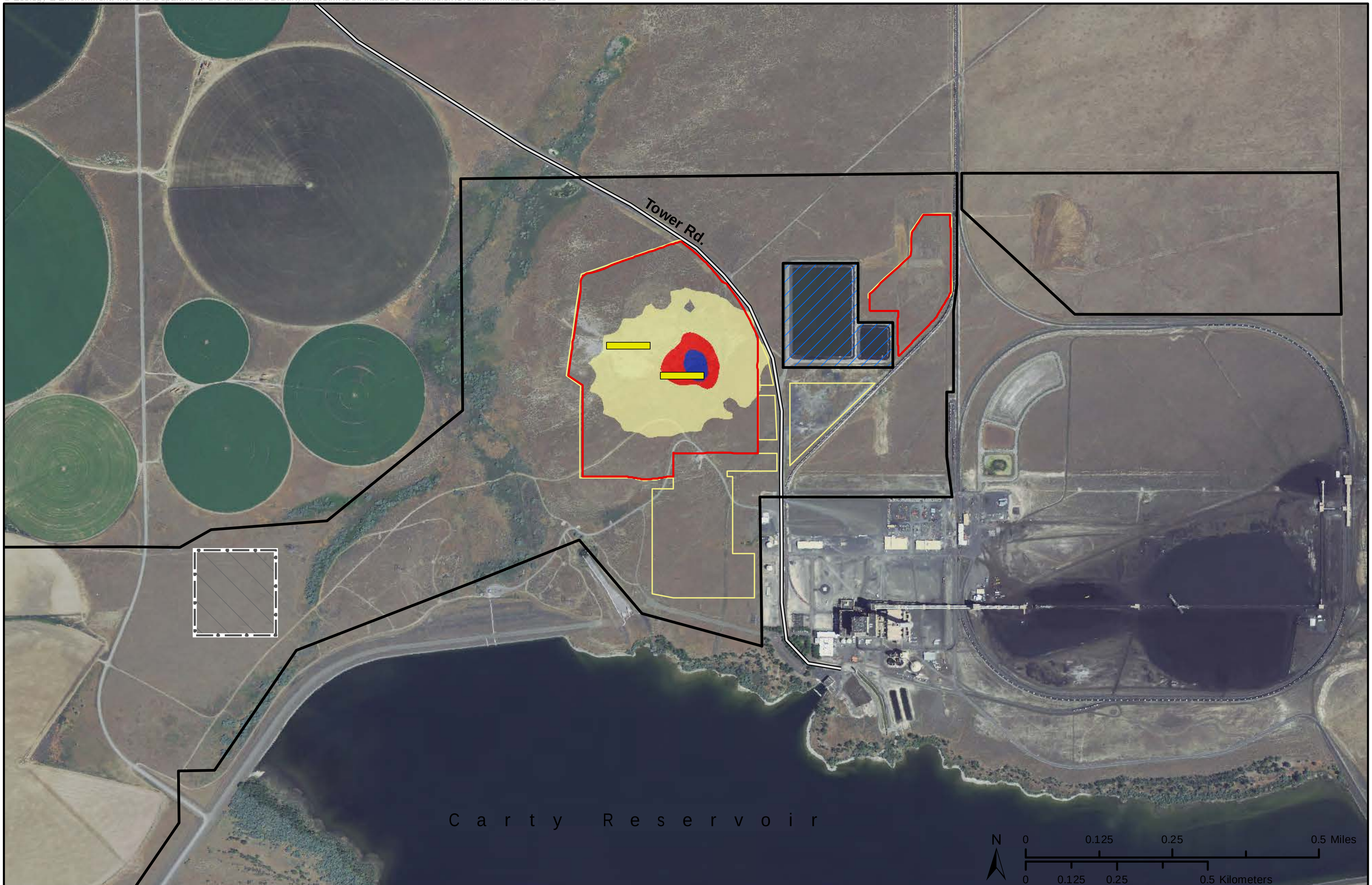


Figure Z-7
Cooling Tower Projected Average Cadmium Deposition Rate [kg/(sq.km-month)]
PGE Carty Generating Station
Application for Site Certificate



- Cooling Tower
- Proposed Energy Facility Site
- Temporary Construction Areas
- Proposed Grassland Switchyard
- Site Boundary
- Existing Boardman Evaporation Pond
- Tower Road

Chromium kg/(sq.km-mo)

- 0.01-0.065
- 0.0651 - 0.12
- 0.121 - 0.175

Figure Z-8
Cooling Tower Projected Average Chromium Deposition Rate [kg/(sq.km-month)]
PGE Carty Generating Station
Application for Site Certificate

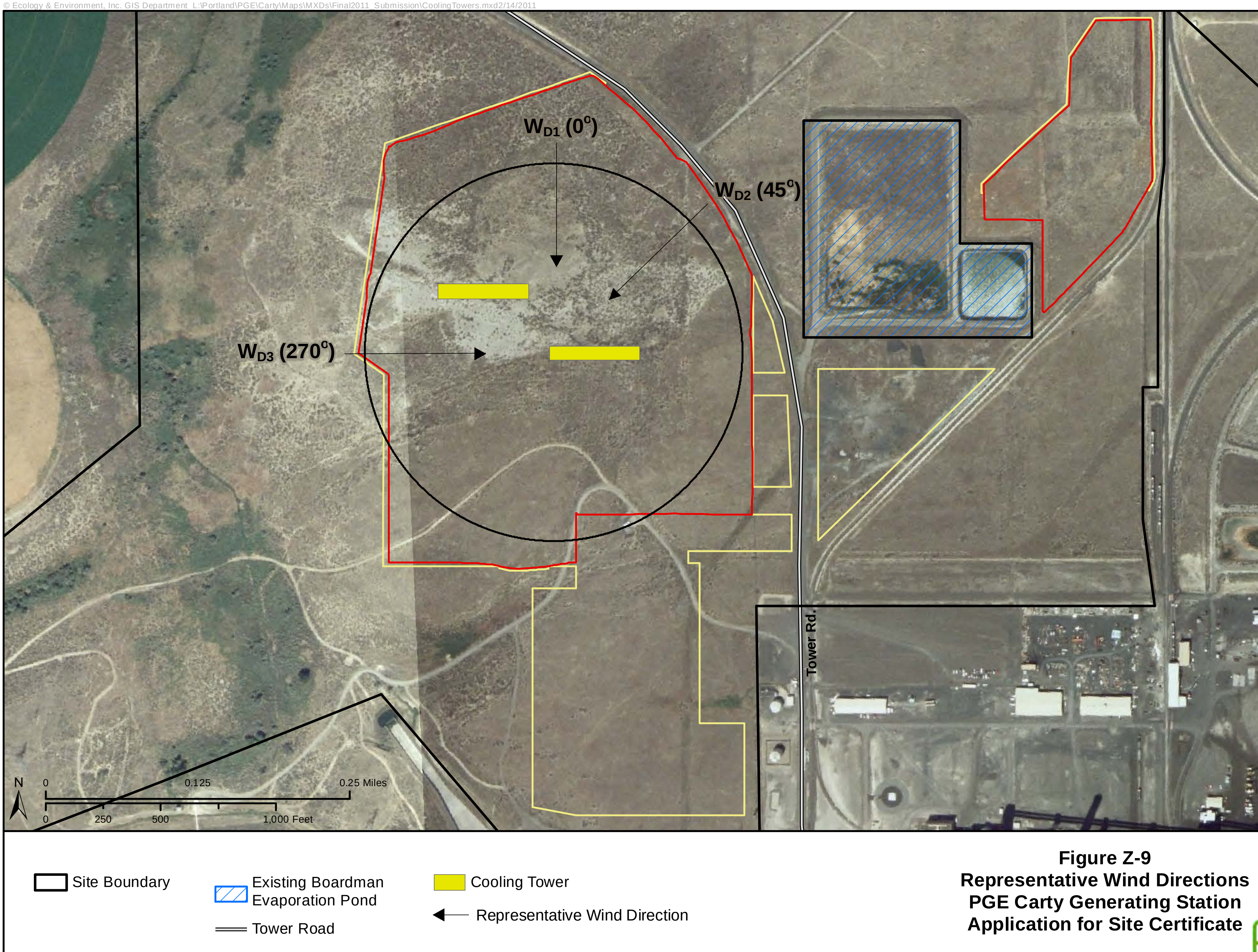


Figure Z-9
Representative Wind Directions
PGE Carty Generating Station
Application for Site Certificate

EXHIBIT AA
ELECTRIC AND MAGNETIC FIELDS
OAR 345-021-0010(1)(aa)

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APPENDICES

AA.1 INTRODUCTION

OAR 345-021-0010(1)(aa) *If the proposed facility includes an electric transmission line:*

Response: An evaluation of electric and magnetic fields (EMF) is provided for the proposed transmission line.

AA.2 SUMMARY

Oscillating electric and magnetic fields (EMF) at power frequency are generated by all electrical devices. The earth itself has naturally occurring steady-state magnetic and electric fields. This exhibit addresses the estimates of the maximum possible EMF strengths that would be produced by distributing energy for the Carty Generating Station through the existing Boardman to Slatt transmission line; and installing either a new single-circuit 500-kilovolt (kV) transmission line from the Carty Generating Station to the Slatt Substation or installing new double-circuit (DC) transmission lines from the Carty Generating Station to the Slatt Substation. These estimates are computed for a height of 1 meter (m) (3.28 feet) above the ground and include the canceling effects of other electrical transmission lines existing along the proposed transmission line rights-of-way (ROWs).

When a conductor is energized, an electric field is formed around the conductor that is proportionate to the energization voltage. The strength of the electric field is independent of the current flowing in the conductor. When alternating current (AC) flows through a conductor, an alternating magnetic field is created around the conductor. Areas of equal magnetic field intensity can be envisioned as concentric cylinders with the conductor at the center. The magnetic field intensity drops rapidly with distance from the conductor.

In AC power systems, voltage swings positive to negative and back to positive, a 360-degree cycle, 60 times every second. Current follows the voltage, flowing forward, reversing direction, and returning to the forward direction, again a 360-degree cycle, 60 times every second. Each AC transmission circuit carries power over three conductors. One phase of the circuit is carried by each of the three conductors. The AC voltage and current in each phase conductor is out of sync with the other two phases by 120 degrees, or one-third of the 360-degree cycle. The fields from these conductors tend to cancel out because of the phase difference, which is referred to as phase cancellation. However, a person standing on the ROW under a transmission line will not be equidistant from all conductors, which results in a net field at the person's location. The strength of the magnetic field depends on the current in the conductor, the geometry of the structures, the degree of cancellation from other conductors, and the distance from the conductors.
The conductor arrangements for the existing Boardman-Slatt and proposed Carty-Slatt 500-kV transmission lines are provided in Appendix AA-1, along with three existing 500-kV and two existing 230-kV transmission lines on shared ROW near the Slatt 500-kV substation.

Figures 3, 4, and 5 in Appendix AA-1 illustrate the typical proposed structural configurations for the existing ROW for Cases 1 through 4 and Case 6 for the existing Boardman-Slatt and the new Carty-Slatt transmission lines near the new Grassland Switchyard. Case 1 is the existing, or baseline condition. Case 2 considers the effects of one Carty Generating Station block on the existing line from Boardman to Slatt via the new Grassland Switchyard. Case 3 considers the effects of one Carty Generating Station block and a new line to Slatt via the new Grassland Switchyard. Case 4 considers the effects of two Carty Generating Station blocks and a new line to Slatt via the new Grassland Switchyard. Case 5 initially considered a line configuration and power flow that was later deemed not feasible; hence, Case 5 is not used in this report. Case 6 considers the effects of two Carty Generating Station blocks and a new double circuit line to Slatt via the new Grassland Switchyard.

Figures 8, 9, and 10 in Appendix AA-1 illustrate the typical proposed structural configurations near the Slatt Substation for the shared ROW with five existing transmission lines for Cases 1 through 4 and Case 6, including the existing Boardman-Slatt and Proposed Carty-Slatt transmission lines. Except for special construction required for crossing under other transmission lines, the ground-level magnetic field intensity across the corridor is determined by the currents and geometry of these facilities.

AA.3 INFORMATION ABOUT THE EXPECTED ELECTRIC AND MAGNETIC FIELDS

OAR 345-021-0010(1)(aa)(A) *Information about the expected electric and magnetic fields, including:*

(i) The distance in feet from the proposed centerline of each proposed transmission line to the edge of the right-of-way;

Response: Figures 3 through 5 and 8 through 10 of the *2009 Electric and Magnetic Fields Study* (provided as Appendix AA-1 to this exhibit) show the centerline of the proposed transmission line to the edge of ROW. Near the proposed Grassland Switchyard, Case 2 would use the existing Boardman to Slatt transmission line, which is approximately 550 feet from the southern edge of the ROW and approximately 250 feet from the northern edge. The new transmission line proposed in Cases 3, 4, and 6 would be located approximately 350 feet from the southern edge of the ROW and approximately 350 feet from the northern edge of the ROW. In the shared ROW near the Slatt substation, the transmission line in Case 2 would be approximately 450 feet from the southern edge of the ROW and approximately 680 feet from the northern edge. The new transmission line proposed in Cases 3, 4, and 6 would be located approximately 300 feet from the southern edge and 830 feet from the northern edge of the ROW.

(ii) The type of each occupied structure, including, but not limited to, residences, commercial establishments, industrial facilities, schools, daycare centers and hospitals, within 200 feet on each side of the proposed centerline of each proposed transmission line;

Response: See the response for (iii) below.

(iii) The approximate distance in feet from the proposed centerline to each structure identified in OAR 345-021-0010(1)(aa)(A);

Response: There are no structures within 200 feet of the proposed transmission centerline.

(iv) At representative locations along each proposed transmission line, a graph of the predicted electric and magnetic fields levels from the proposed centerline to 200 feet on each side of the proposed centerline;

Response: Appendix A of the *2009 Electric and Magnetic Fields Study* (provided as Appendix AA-1 to this exhibit) provides graphs of the predicted electric and magnetic fields levels from each of the five cases evaluated. Calculations were made for both electric and magnetic fields. In addition, calculations were made for radio noise during both dry and wet weather to determine potential radio and television interference impact. Values for both sides of the ROW as well as the maximum intensity for each parameter within the ROW were tabulated.

Tables AA-1 and AA-2 illustrate the magnetic and electric fields resulting from the Carty Generating Station and Boardman Plant to the Slatt Substation alternative transmission line arrangements in conjunction with existing lines. Parameter intensities continue to decrease as distance increases from the ROW boundaries.

Maximum magnetic fields are produced at the maximum conductor currents. The outputs used for calculating the magnetic and electric field-strengths are assumed to be typical peak-load outputs from the generators and are therefore higher than the nominal outputs. As can be seen from the calculations, at the worst case, the field-strengths at the edges of ROW are within the requirements of OAR 345-024-0090, as they do not exceed 9 kV/m.

As shown by the results in Tables AA-1 and AA-2, induced currents resulting from the transmission line and related or supporting facilities will be as low as reasonably achievable. In fact, by phasing the proposed new circuit to maximize field cancellation, the EMF levels calculated are essentially unchanged from the current condition.

Table AA-1 EMF Cuts at New 500 kV Grassland Switchyard Near Boardman Plant and Proposed Carty Generating Station

Case Designation	South Edge ROW	Maximum within ROW	North Edge ROW	200' North of Northernmost Existing C/L
Electric Field (kV/M)				
Case 1	0.019	7.695	0.327	0.170
Case 2	0.019	7.695	0.327	0.170
Case 3	0.063	7.705	0.351	0.193
Case 4	0.063	7.705	0.351	0.193
Case 6	**0.033**	**7.680**	**0.307**	**0.153**
Magnetic Field (milliGauss)				
Case 1	0.5	110.4	7.0	4.0
Case 2	1.0	204.6	12.9	7.4
Case 3	1.7	99.2	7.6	4.6
Case 4	2.4	141.8	10.9	6.6

Table AA-1 EMF Cuts at New 500 kV Grassland Switchyard Near Boardman Plant and Proposed Carty Generating Station

Case Designation	South Edge ROW	Maximum within ROW	North Edge ROW	200' North of Northernmost Existing C/L
Case 6	0.7	96.3	6.2	3.6
Radio Noise during Fair Weather (dB)				
Case 1	30.0	66.1	43.5	40.3
Case 2	30.0	66.1	43.5	40.3
Case 3	34.2	66.3	43.3	40.2
Case 4	34.2	66.3	43.3	40.2
Case 6	39.9	68.2	43.4	40.3
Radio Noise during Rain (dB)				
Case 1	47.0	83.1	60.5	57.3
Case 2	47.0	83.1	60.5	57.3
Case 3	51.2	83.3	60.3	57.2
Case 4	51.2	83.3	60.3	57.2
Case 6	56.9	85.2	60.4	57.3

Table AA-2 EMF Cuts Near Slatt 500 kV Substation

Case Designation	South Edge ROW	Maximum within ROW	North Edge ROW	200' North of Northernmost Existing C/L
Electric Field (kV/M)				
Case 1	0.050	8.547	0.605	0.040
Case 2	0.050	8.547	0.605	0.040
Case 3	0.105	8.546	0.603	0.043
Case 4	0.105	8.546	0.603	0.043
Case 6	0.053	8.548	0.607	0.038
Magnetic Field (milliGauss)				
Case 1	2.7	313.6	20.3	5.1
Case 2	3.3	313.0	20.5	5.2
Case 3	4.2	313.3	20.4	5.2
Case 4	5.2	312.9	20.6	5.3
Case 6	2.9	313.7	20.3	5.0
Radio Noise during Fair Weather (dB)				
Case 1	31.7	67.7	36.6	30.7
Case 2	31.7	67.7	36.6	30.7
Case 3	35.7	67.7	36.6	30.6
Case 4	35.7	67.7	36.6	30.6
Case 6	41.6	68.2	36.6	30.7
Radio Noise during Rain (dB)				
Case 1	48.7	84.7	53.6	47.7
Case 2	48.7	84.7	53.6	47.7
Case 3	52.7	84.7	53.6	47.6
Case 4	52.7	84.7	53.6	47.6
Case 6	58.6	85.2	53.6	47.7

..

(v) *Any measure applicant proposes to reduce electric or magnetic field levels;*
Response: Operators of transmission lines attempt to organize the conductors attached to structures in ways that are consistent and intuitive so that line workers are less apt to make mistakes in operations. For the transmission line proposed in Cases 2 through 4 and Case 6, the most common single-circuit transmission conductor arrangement would place the B-phase conductor at the top position, the C-phase conductor at the bottom left, and the A-phase conductor at the bottom right position, looking west along the ROW. For the double-circuit transmission line proposed in Case 6, the most common transmission conductor arrangement would place the phase conductor positions as A-phase, B-phase, and C-phase top-to-bottom on the left side of the DC structure and C-phase, B-phase, and A-phase top-to-bottom on the right side of the DC structure.

(vi) *The assumptions and methods used in the electric and magnetic field analysis, including the current amperes on each proposed transmission line;*

Response: To estimate the maximum EMF, calculations are performed at mid-span where the conductor is positioned at its lowest point between structures (the estimated maximum sag point). The magnetic fields are computed at 1 m (3.28 feet) above the ground using a program called "Corona and Field Effect Program" developed by the Bonneville Power Administration (BPA). This program has been used to predict electric and magnetic field levels for many years and has been confirmed by field measurements by numerous utilities. Calculations use 1.05 per unit of nominal voltage for the 230-kV circuits and 1.10 per unit of normal voltage for the 500-kV circuits. All loads on all circuits are assumed to be maximum and coincident. This condition would occur rarely and is therefore a conservative assumption. Electric fields are voltage dependent and will remain the same when a transmission line is operated at a given voltage, regardless of load. Magnetic fields vary proportionally with current. They are higher when the current is higher and produce higher ground-level magnetic fields. Since the average loads would be less than the maximum operating current, the proposed transmission line typically would produce lower EMF than predicted for the maximum condition. The dimensions of the existing BPA power lines were estimates from the data provided from BPA and site investigations.
The actual distance between the centerlines of the various circuits and the edge of the ROW are listed in Appendix AA-1, Figures 3 through 5 and Figures 8 through 10. The circuit spacing used for these estimates is representative of the minimum spacing.
In this EMF analysis, the maximum loading of the existing Boardman to Slatt 500-kV line is assumed to be 720 amps (623 MVA). The power pactor is assumed to be 95 percent for all circuit loads. Table AA-3 indicates the circuit loading assumed for this study.

Table AA-3 Circuit Loading

Case Designation	Amps	MVA
Existing Boardman-Slatt 500kV (*BN-SL*)		
Case 1	720	623
Case 2	1267	1097
Case 3	634	549
Case 4	907	785
Case 6	605	524
Proposed Carty-Slatt Line 1 500kV (CT-SL1)		
Case 3	634	549
Case 4	907	785
Case 6	605	524
Proposed Carty-Slatt Line 2 500kV (CT-SL2)		
Case 6	605	524
Existing Ashe-Marion L2 500kV (AS-MR2)		
Cases 1-4 and 6	1115	966
Existing Ashe-Marion L2 500kV (AS-MR2)		
Cases 1-4 and 6	1115	966
Existing Ashe-Slatt L1 500kV (AS-SL1)		
Cases 1-4 and 6	1995	1728
Existing Coyote Springs-Slatt 500kV (CS-SL)		
Cases 1-4 and 6	1921	1663
Existing Tower Rd-Alkali Canyon 230kV (TR-AC)		
Cases 1-4 and 6	458	397
Existing McNary-Jones Canyon 230kV (MN-JC)		
Cases 1-4 and 6	458	397

(vii) The applicant's proposed monitoring program, if any, for actual electric and magnetic field levels.

Response: There are no monitoring programs proposed to measure the actual EMF levels generated by the proposed construction.

AA.4 ALTERNATIVE METHODS TO REDUCE RADIO INTERFERENCE

OAR 345-021-0010(1)(aa)(B) *An evaluation of alternative methods and costs of reducing radio interference likely to be caused by the transmission line in the primary reception area near interstate, U.S. and state highways.*

Response: Based on analysis provided in Appendix AA-1, no alternative methods to reduce radio and television interference are necessary.

APPENDIX AA-1

2009 Electric and Magnetic Fields (EMF) Study

2009 Electric and Magnetic Fields Study

PORTLAND GENERAL ELECTRIC
CARTY 500-kV TRANSMISSION LINE EMF STUDY

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PORTLAND GENERAL ELECTRIC
CARTY 500-kV TRANSMISSION LINE EMF STUDY

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A. Electric and Magnetic Field Plots

B. BPA Corona & Field Effects Program Tabular Results

I INTRODUCTION

A new gas turbine generation station is being proposed at Portland General Electric Company's (PGE) Carty site. This plant would be located adjacent to PGE's existing Boardman Plant. PGE owns and operates an existing 500-kilovolt (kV) transmission line which extends from the Boardman Plant to the Slatt Substation, a distance of approximately 17.8 miles. Presently the existing Boardman to Slatt 500-kV transmission line is centered 150 feet south of the northern edge of an existing 700 foot wide right-of-way (ROW). The proposed new line(s) which parallel the existing line would be located 200 feet south of the existing line.

The goal of the study is to determine the electric and magnetic field effects and radio interference due to the introduction of new load from the proposed Carty Generating Station. Case 1 is the existing, or baseline condition. Case 2 considers the effects of one Carty Generating Station block on the existing line from Boardman to Slatt via a new switchyard. Case 3 considers the effects of one Carty Generating Station block and a new line to Slatt via a new switchyard. Case 4 considers the effects of two Carty Generating Station blocks and a new line to Slatt via a new switchyard. Case 5 initially considered a line configuration and power flow that was later deemed not feasible; hence Case 5 is not used in this report. Case 6 considers the effects of two Carty Generating Station blocks and a new double circuit line to Slatt via a new switchyard.

Maximum effects will be reported within the ROW, at the north ROW edge and at the south ROW edge. Radio noise will be reported for both fair weather and rain conditions. Figures 2, 6 and 7 show the transmission line configurations at the locations were section cuts were analyzed.

II ASSUMPTIONS & METHODOLOGIES

The following assumptions and methodologies were used in the development of the study.

- Calculations Method: Output Results are based upon the algorithms in the BPA Corona & Field Effects Program (BPA CFE) software developed by Bonneville Power Administration (BPA).
- Calculations use 1.05 per unit of nominal voltage for the 230-kV lines and 1.10 for the 500-kV lines.
- Vertical height of Electric Field, Magnetic Field and Radio Interference sensor is 3.28 feet (1 meter).
- Radio-noise levels are reported at a single measurement frequency of 1 megahertz (MHz).
- The existing structure type from Boardman to Slatt is a delta configuration single circuit. This circuit remains the same configuration for all cases analyzed. A drawing of this structure is provided in Figure 3.
- The single proposed 500-kV line for Case 3 and Case 4 will have a lattice structure single circuit configuration as shown in Figure 4.
- The two proposed 500-kV lines for Case 6 will have a lattice structure vertical double circuit configuration as shown in Figures 5 and 11.
- The existing structure types entering in the joint ROW near Slatt Substation are Steel Lattice single circuit configuration. An assumed configuration sketch of this joint ROW is provided in Figure 8.
- Proposed Single Circuit Phase Delta configuration (Case 3 and Case 4): CBA south to north (looking west) for the single circuit line to maximize field cancellation.
- Proposed Double Circuit Phase Vertical configuration (Case 6): ABC-CBA top to bottom (looking west) for the double circuit lines to maximize field cancellation.
- Phase conductors and ground clearance

    Existing Boardman-Slatt L1 (*BN-SL*) 500-kV has 1780 kcmil ACSR with a ground clearance of 35 feet at midspan.

    Proposed Carty-Slatt L1 (*CT-SL1*) 500kV has 1780 kcmil ACSR with a ground clearance of 35 feet at midspan (Case 3 & Case 4).

Proposed Carty-Slatt L2 (*CT-SL2*) 500kV has 1780 kcmil ACSR with a ground clearance of 35 feet at midspan (Case 6).

Existing Ashe-Marion L2 (*AS-MR2*) triple bundle 1780 kcmil ACSR with a ground clearance of 33 feet at midspan.

Existing Ashe-Slatt L1 (*AS-SL1*) 500kV has triple bundle 1780 kcmil ACSR with a ground clearance of 33 feet at midspan.

Existing Coyote Springs-Slatt (*CS-SL*) 500kV has double bundle 1780 kcmil ACSR with a ground clearance of 33 feet at midspan.

Existing Tower Rd-Alkali Canyon (*TR-AC*) 230kV has single 1272 kcmil ACSR with a ground clearance of 27 feet at midspan.

Existing McNary-Jones Canyon (*MN-JC*) 230kV has single 1272 kcmil ACSR with a ground clearance of 27 feet at midspan.

- Shield wires

Two 7#8 Alumoweld for the existing Boardman-Slatt (*BN-SL*) Line.

Two 7#8 Alumoweld for the existing Ashe-Marion L2 (*AS-MR2*) Line.

Two 7#8 Alumoweld for the existing Ashe-Slatt L1 (*AS-SL1*) Line.

Two AFL CC-57/465 OPGW for the proposed Single Circuit (SC) Carty-Slatt L1 (*CT-SL1*) Line.

Two AFL CC-57/465 OPGW for the proposed Double Circuit **(**DC) Carty-Slatt L1 (*CT-SL1*) Line and Carty-Slatt L2 (*CT-SL2*) Line.

The existing Tower Rd-Alkali Canyon (*TR-AC*) 230kV Line and the McNary-Jones Canyon (*MN-JC*) 230kV Line were modeled without shield wires.

- Case Descriptions are shown graphically in Figure 1.
    - **Case 1:** Boardman – Slatt 500-kV SC Line *(BN-SL)*
      (Existing SC Line – Boardman Generation)
      Existing Boardman to Slatt single circuit. Existing Boardman to Slatt carries all of Boardman generation.

    - **Case 2:** New SY – Slatt 500-kV SC Line *(BN-SL)*
      (Existing SC Line – Boardman and Carty Block 1 Generation)
      Existing Boardman to Slatt with the addition of a single circuit generation lead from Carty Block 1 to a new switchyard. Carty Block 1 to New Switchyard (SY) single circuit lead carries all of Carty Block 1 generation

on one circuit. Existing Boardman to Slatt carries all of Boardman and Carty Block 1 generation from the New SY to Slatt.

- **Case 3:** New SY – Slatt 500-kV SC Lines, Option 1 *(BN-SL & CT-SL1*)

  (Existing SC Line – ½ Boardman and Carty Block 1 Generation)
  (New SC Line – ½ Boardman and Carty Block 1 Generation)

  Existing Boardman to Slatt single circuit with the addition of a new single circuit line and a new single circuit generation lead from Carty Block 1 to a new switchyard. Carty Block 1 to new SY single circuit lead carries all of Carty Block 1 generation on one circuit. The new single circuit line carries ½ Carty Block 1 generation from the New SY to Slatt. The existing single circuit line carries ½ Boardman generation from the New SY to Slatt.

- **Case 4:** New SY – Slatt 500-kV SC Lines, Option 2 *(BN-SL & CT-SL1*)

  (Existing SC Line – ½ Boardman and Carty Blocks 1 & 2 Generation)
  (New SC Line – ½ Boardman and Carty Blocks 1 & 2 Generation)

  Existing Boardman to Slatt single circuit with the addition of a new single circuit line and a two new single circuit generation leads from Carty Blocks 1 & 2 to a new switchyard. Carty Blocks 1 & 2 to New SY single circuit leads carry all of Carty Block 1 & 2 generation on two circuits. The new single circuit line carries ½ Boardman and Carty Block 1 & 2 generation from the New SY to Slatt. The existing single circuit line carries ½ Boardman and Carty Blocks 1 & 2 generation from the New SY to Slatt.

- **Case 5:** Not Used. Case 5 initially considered a line configuration and power flow that was later deemed not feasible; hence case 5 is not used in this report.

- **Case 6:** New SY – Slatt *(BN-SL)* 500-kV SC and DC Lines *(CT-SL1 & CT-SL2*)

  (Existing SC Line – $^{1}/_{3}$ Boardman and Carty Blocks 1 & 2 Generation)
  (New DC Line – $^{1}/_{3}$ Boardman and Carty Blocks 1 & 2 Generation, on each circuit)

  Existing Boardman to Slatt single circuit with the addition of a new double circuit line and two new single circuit generation leads from Carty Blocks 1 & 2 to a new switchyard. Carty Blocks 1 & 2 to New SY single circuit leads carry all of Carty Block 1 & 2 generation on two circuits. The new double circuit line carries $^{1}/_{3}$ Boardman and Carty Block 1 & 2 generation from the New SY to Slatt on each circuit. The existing single circuit line carries $^{1}/_{3}$ Boardman and Carty Block 1 & 2 generation from the New SY to Slatt.

Table I Circuit Loading		
Case Designation	**Amps**	**MVA**
Existing Boardman-Slatt 500kV (*BN-SL*)		
Case 1	720	623
Case 2	1267	1097
Case 3	634	549
Case 4	907	785
Case 6	605	524
Proposed Carty-Slatt Line 1 500kV (*CT-SL1*)		
Case 3	634	549
Case 4	907	785
Case 6	605	524
Proposed Carty-Slatt Line 2 500kV (*CT-SL2*)		
Case 6	605	524
Existing Ashe-Marion L2 500kV (*AS-MR2*)		
Cases 1-4 and 6	1115	966
Existing Ashe-Marion L2 500kV (*AS-MR2*)		
Cases 1-4 and 6	1115	966
Existing Ashe-Slatt L1 500kV (*AS-SL1*)		
Cases 1-4 and 6	1995	1728
Existing Coyote Springs-Slatt 500kV (*CS-SL*)		
Cases 1-4 and 6	1921	1663
Existing Tower Rd-Alkali Canyon 230kV (*TR-AC*)		
Cases 1-4 and 6	458	397
Existing McNary-Jones Canyon 230kV (*MN-JC*)		
Cases 1-4 and 6	458	397

Figure 1 – Case Configurations

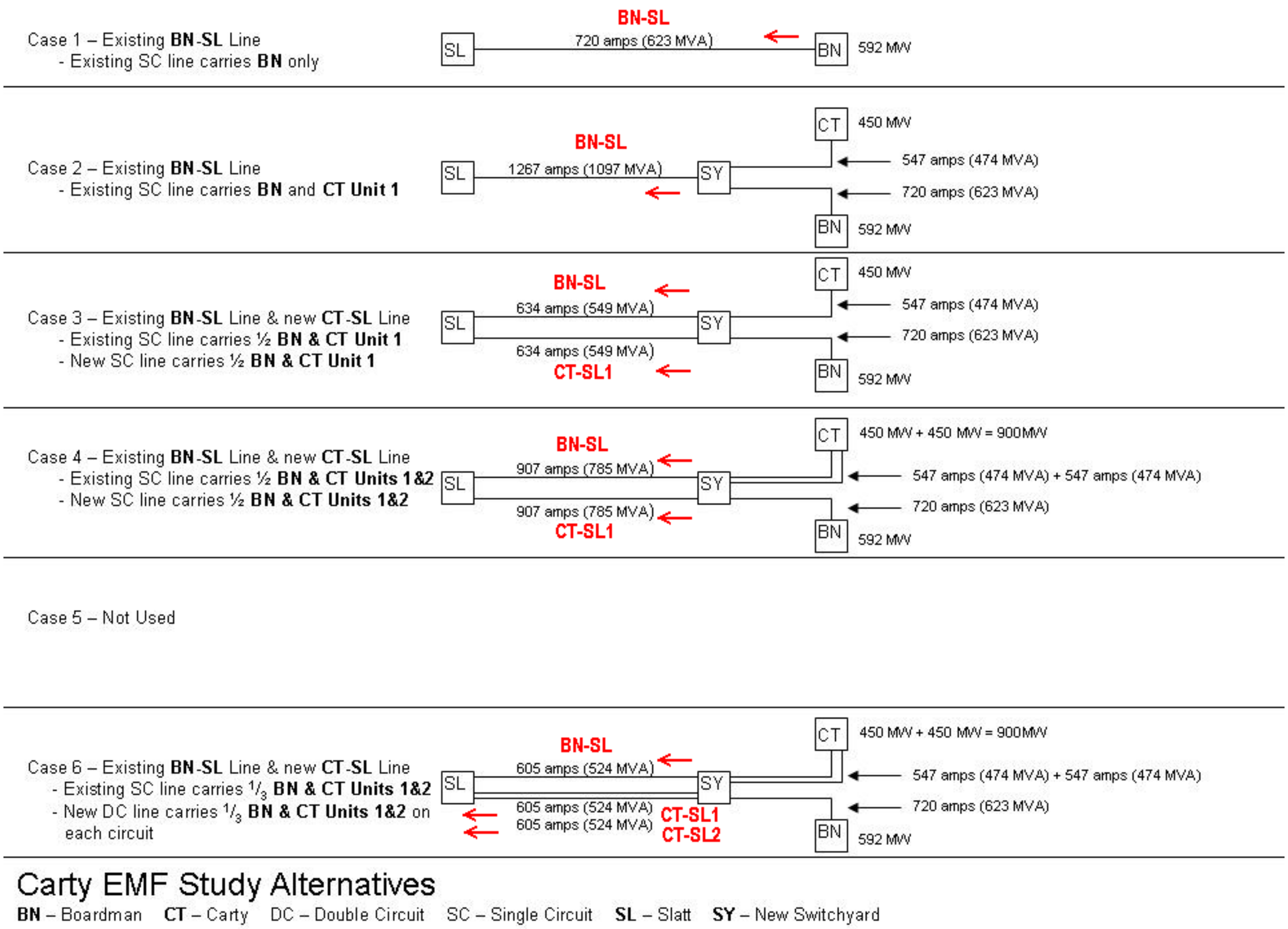


Figure 2 - EMF cut near new Switchyard at Boardman Plant and Proposed Carty Generating Station

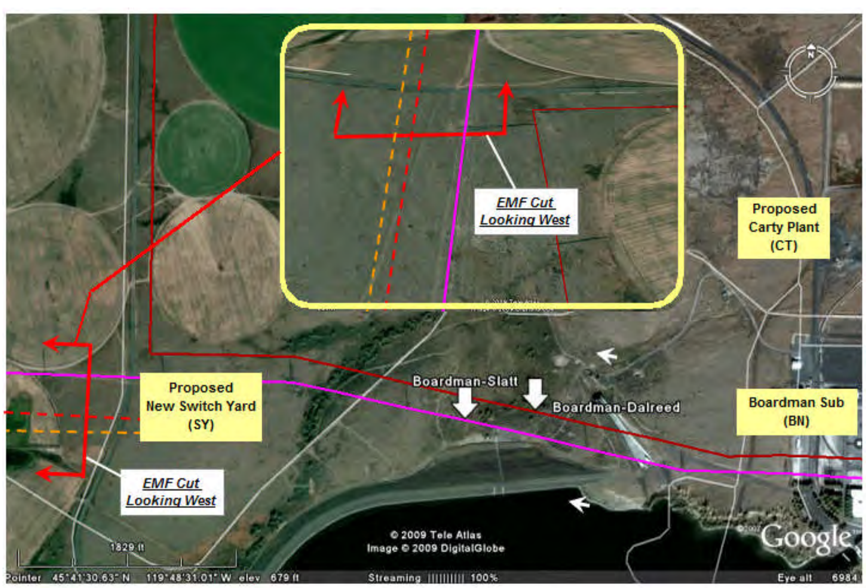


Figure 3 - ROW of Case 1 & Case 2 EMF Cut near new Switchyard at Boardman Plant and Proposed Carty Generating Stations

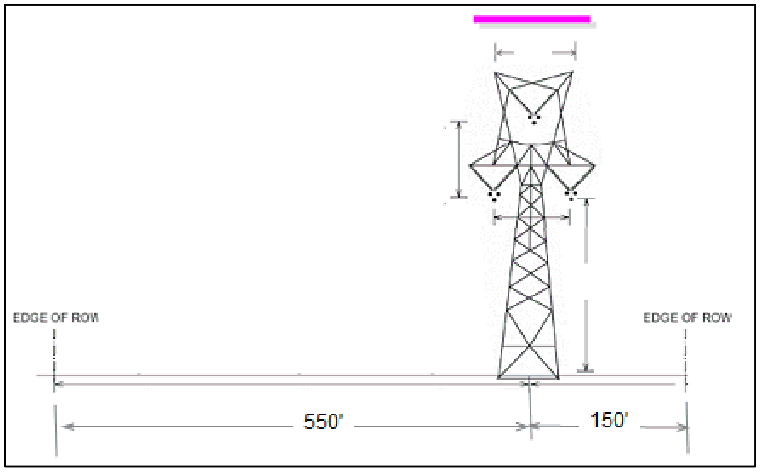


Figure 4 - ROW of Case 3 & Case 4 EMF cut near new Switchyard at Boardman Plant and Proposed Carty Generating Stations

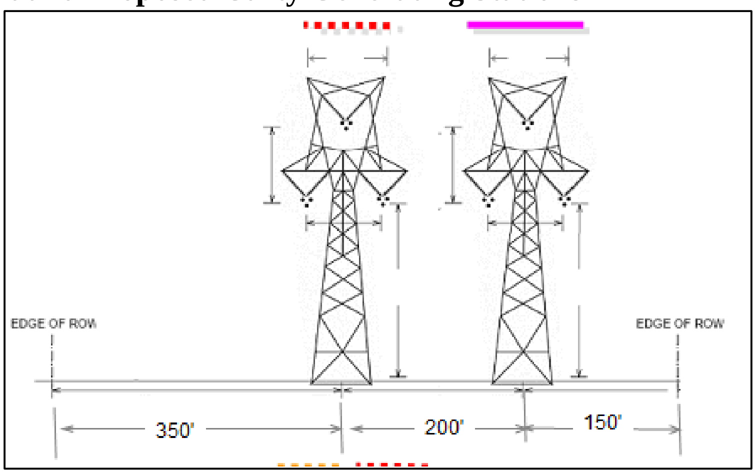


Figure 5 - ROW of Case 6 EMF cut near new Switchyard at Boardman Plant and Proposed Carty Generating Stations

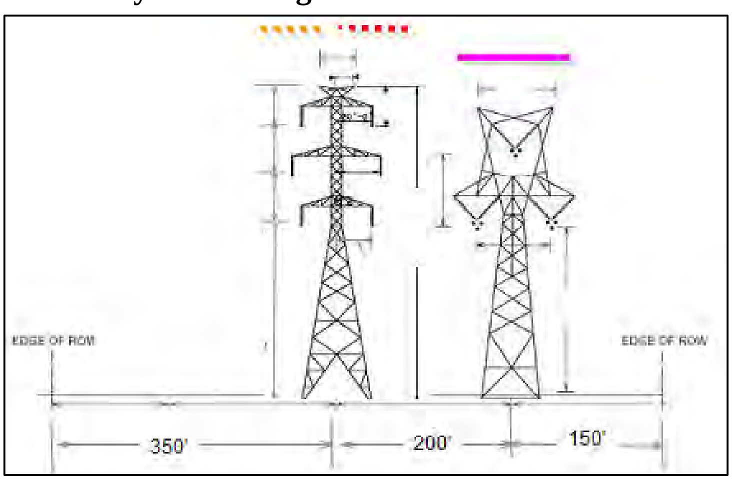


Figure 6 – EMF cut at Slatt Substation Joint Corridor ROW

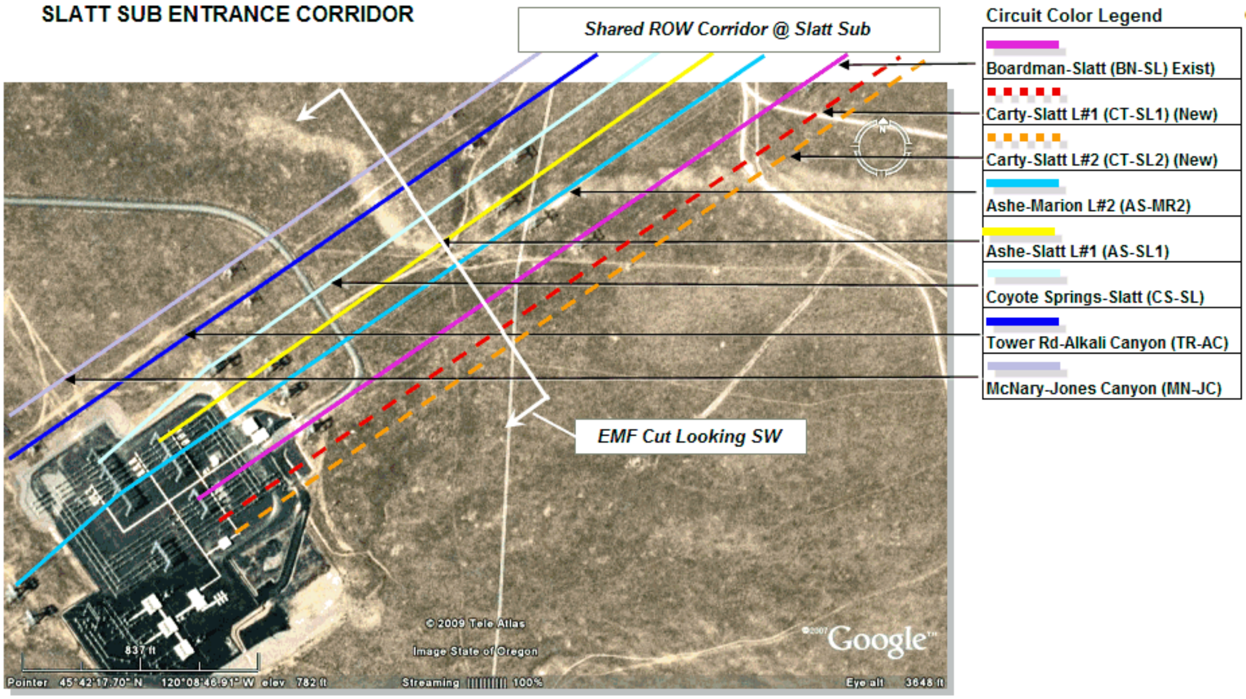


Figure 7 – 3-D EMF cut at Slatt Substation Joint Corridor ROW

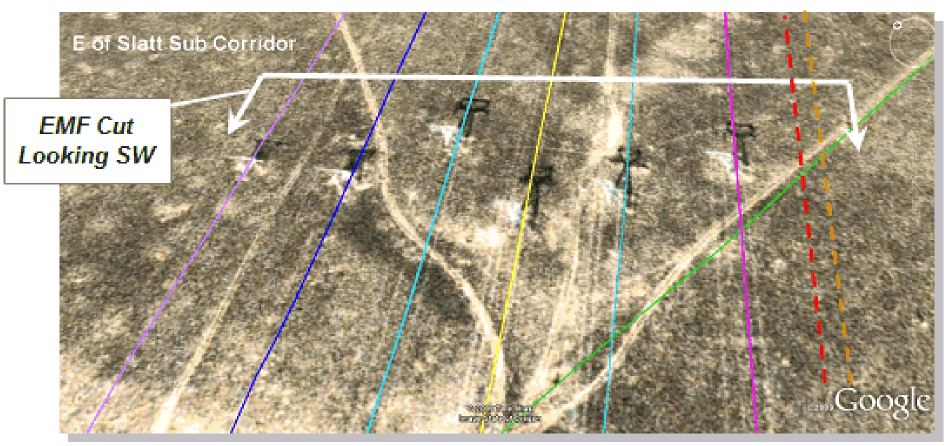


Figure 8 - Case 1 & Case 2 Configuration for EMF cut at Slatt Substation Joint Corridor ROW

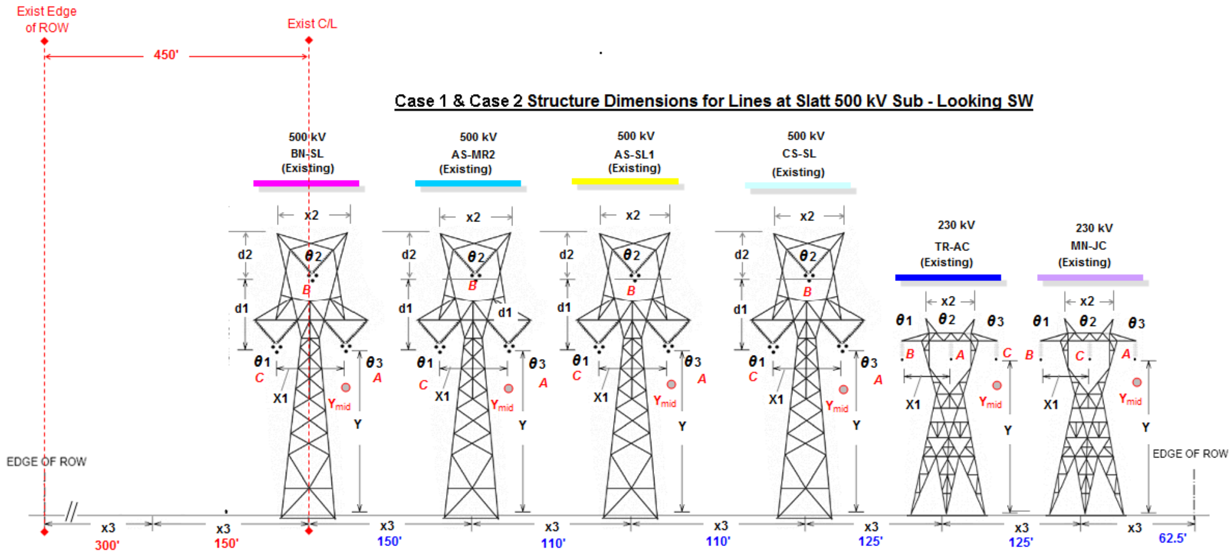


Figure 9 - Case 3 & Case 4 Configuration for EMF cut at Slatt Substation Joint Corridor ROW

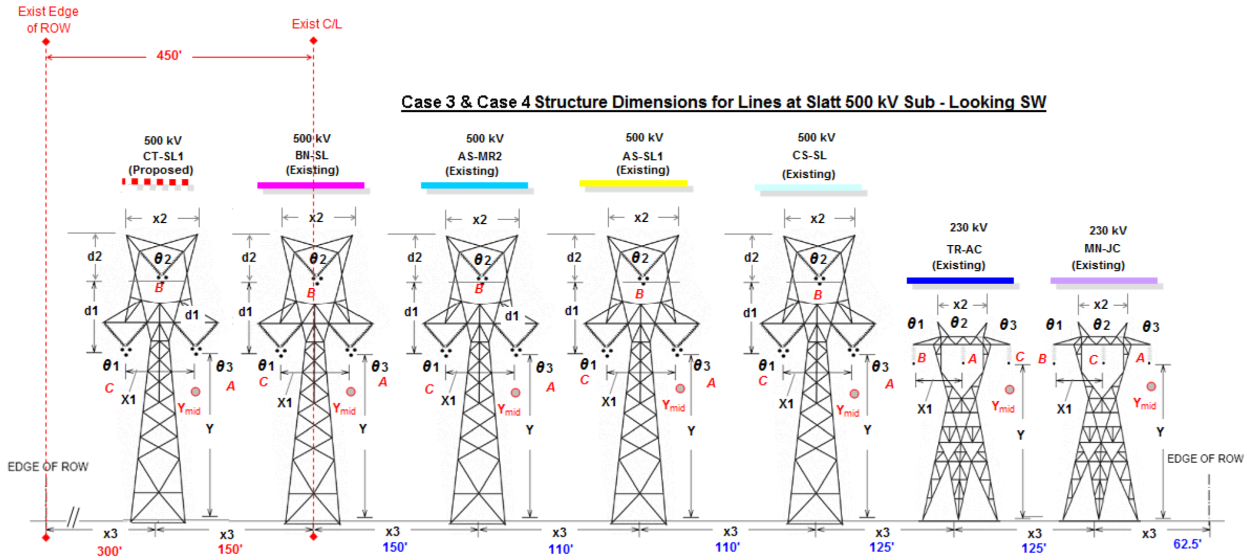
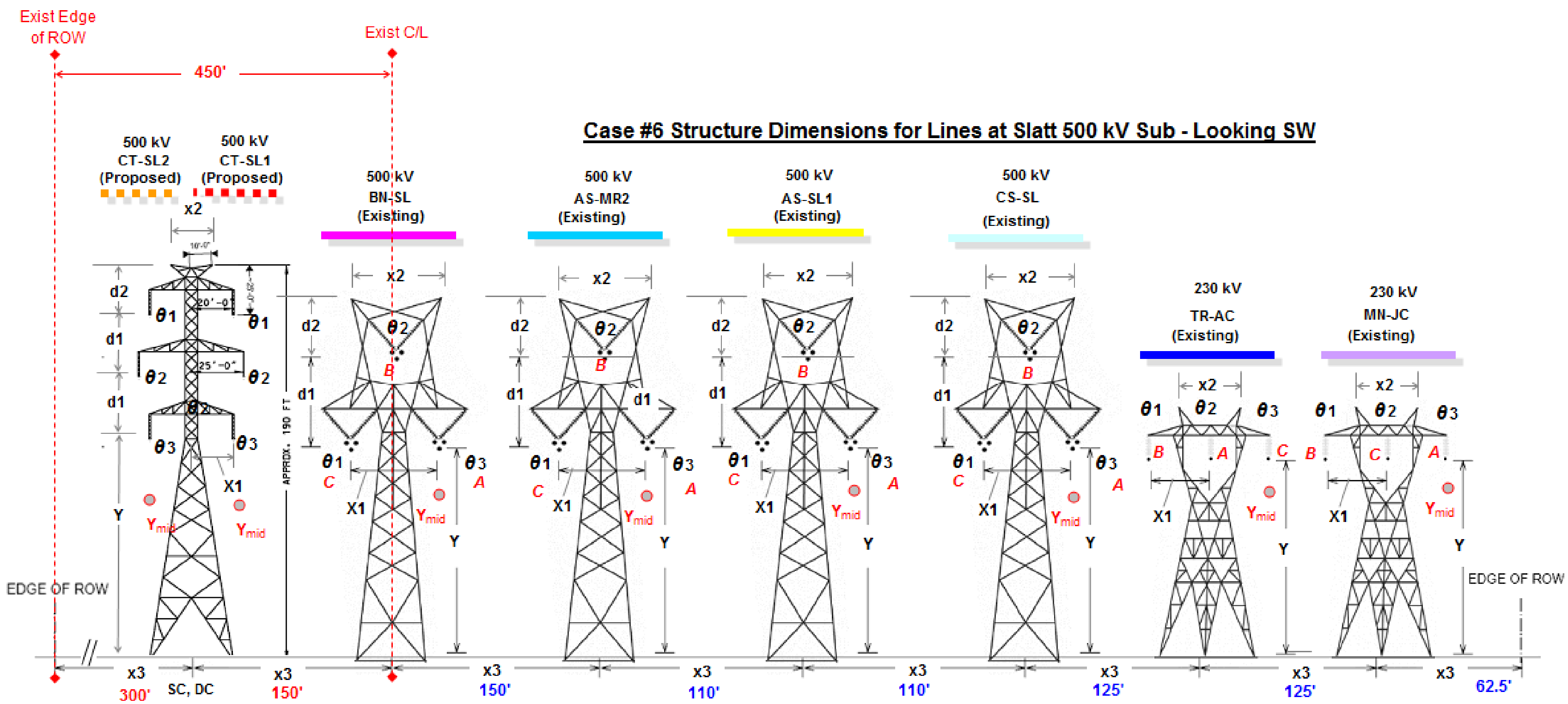


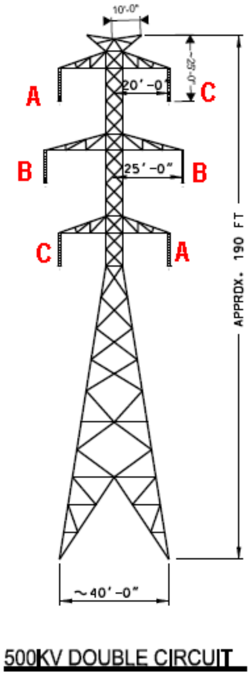
Figure 10– Case 6 Double Circuit (DC) 500 kV Vertical Configuration for EMF cut at Slatt Substation Joint Corridor ROW



Circuit Color Code	Circuit Description	Horiz Distances: Ph Dist to C/L X1 (Ft)	Horiz Distances: SW Sep Dist X2 (Ft)	Horiz Distances: ROW Dist C/L to C/L X3 (Ft)	Vertical Distances: Bot Ph Ht @ Str Y (Ft)	Vertical Distances: MidSpan Clr Y_{mid} (Ft)	Vertical Distances: Ph-Ph Sep d1 (Ft)	Vertical Distances: SW-Ph Sep d2 (Ft)	Circuit Phasing (Looking SW): Left or Top θ1	Circuit Phasing (Looking SW): Middle θ2	Circuit Phasing (Looking SW): Right or Bot θ3	Conductor Data: No. of Wires per Phase	Conductor Data: Phase Wire Type	Shield Wire Data: No. of Shield Wires	Shield Wire Data: SW1 Type	Shield Wire Data: SW2 Type	Special Notes: Line Amps (Amps)	Special Notes: Normal Line Amps Flow Dir	Special Notes: Special Notes
	Boardman-Slatt (BN-SL) Exist)	40	25.833	150	88.833	35	27.5	23.167	C	B	A	2	1780 ACSR Chuckar	2	7-#8 ALW	7-#8 ALW	See Case	E-W	Exist Line
	Carty-Slatt L#1 (CT-SL1) (New)	20/25	20	150*	105	35	30	25	A	B	C	2	1780 ACSR Chuckar	2	CC-57/465	CC-57/465	See Case	E-W	Prop Line
	Carty-Slatt L#2 (CT-SL2) (New)	20/25	20	150*	105	35	30	25	C	B	A	2	1780 ACSR Chuckar	2	CC-57/465	CC-57/465	See Case	E-W	Prop Line
	Ashe-Marion L#2 (AS-MR2)	30.667	24	110	95	33	18.667	24	C	B	A	3	1780 ACSR Chukar	2	7#8 ALW	7#8 ALW	1114.9	E-W	Exist Line
	Ashe-Slatt L#1 (AS-SL1)	30.667	24	110	95	33	18.667	24	C	B	A	3	1780 ACSR Chukar	2	7#8 ALW	7#8 ALW	1995.1	E-W	Exist Line
	Coyote Springs-Slatt (CS-SL)	40	-	125	110	33	28.5	-	C	B	A	2	1780 ACSR Chukar	2	7#8 ALW	7#8 ALW	1920.8	E-W	Exist Line
	Tower Rd-Alkali Canyon (TR-AC)	26.333	-	125	75	27	-	-	B	A	C	1	1272 ACSR Pheasant	0	-	-	458.4	E-W	Exist Line
	McNary-Jones Canyon (MN-JC)	26.333	-	62.5	90	27	-	-	B	C	A	1	1272 ACSR Pheasant	0	-	-	458.4	E-W	Exist Line

	O.D. (In)		O.D. (In)
1780 ACSR Chukar	1.602	7-#8 ALW	0.385
1272 ACSR Pheasant	1.382	CC-57/465	0.465

Figure 11 - Case 6 Double Circuit (DC) 500 kV Vertical Configuration



Note: This configuration is proposed for Carty Generating Station-Slatt Sub.

Figure 12 - Photo of Existing Line Configuration at Slatt Substation Joint Corridor ROW

III ELECTRICAL EFFECTS

The electrical effects of a transmission line are those associated with electrical field, magnetic field, and corona. Electric and magnetic fields can result in induced voltage on objects near a transmission line. Corona effects are manifested in audible noise (AN) and radio interference (RI). The effects will be minimized by line location, line design, and construction practices.

CORONA

Corona is a partial electrical breakdown that results in the transformation of energy into very small amounts of light, sound, radio noise, chemical reaction, and heat. Corona results when the voltage gradient surrounding energized conductors or hardware exceeds the breakdown strength of air, resulting in electrical discharges. It is more severe during rainy or damp weather.

Corona is a recognized phenomenon, and it is considered in the design of electrical hardware and equipment as well as in the specific design of a transmission line. To reduce the surface voltage gradient for the line, a double bundle configuration, or two conductors per phase, has been selected. By using a bundle configuration, the “effective” conductor diameter and surface area is significantly increased, thus lowering the surface voltage gradient. The effects of corona were analyzed in the RI analysis at 1,000 kilohertz (kHz).

RADIO INTERFERENCE

Overhead transmissions lines generally do not interfere with normal radio reception. Corona and gap discharges, however, are two potential sources of interference. Corona, as described above, may affect radio reception. However, due to the conductor hardware that will be used and the bundled conductor design, the corona, and thus interference, will be minimal and is not expected to be a problem.

Gap discharges result from electrical discharges between broken or poorly fitting hardware, such as insulators, clamps, and brackets. The hardware is designed to prevent gap discharges; however, mechanical damage due to wind induced (aeolian) vibration, corrosion, gunshot, or other causes may create a condition where gap discharges can occur. Gaps between contact points on hardware, at which small electrical discharges can occur, are created. This phenomenon can be found on lines of all voltages, and sometimes occurs when "slack" or low tension spans result in insufficient tension to keep hardware firmly in contact. The discharge across the small gap acts as a low power electrical transmitter and may interfere with some radio signals.

A much more likely source of radio interference arises through electrical equipment in the home itself. The line voltage and the distance of prospective line routes from residences minimize the likelihood of objectionable audible noise, radio interference, or television interference from the line.

ELECTRIC AND MAGNETIC FIELDS

The change in voltage over distance is known as the electric field. The units describing an electric field are volts per meter (V/m) or kilovolts per meter (kV/m). The electric field becomes stronger near a charged object and decreases with distance away from the object.

Electric fields are a very common phenomenon. Static electric fields can result from friction generated when taking off a sweater or walking across a carpet. Almost all household appliances and other devices that operate on electricity create electric fields.

An electric current flowing in a conductor (electric equipment, household appliance, or otherwise) creates a magnetic field. The most commonly used magnetic field intensity unit is the Gauss or milliGauss (mG), which is a measure of the magnetic flux density (intensity of magnetic field per unit area).

The magnetic fields under transmission and distribution lines and near substations are relatively low, at least in comparison with measurements near many household appliances and other equipment. The magnetic field near an appliance decreases with distance away from the device. The magnetic field also decreases with distance away from electrical power lines and substation equipment (such as transformers and capacitor banks).

There are no national or federal government standards in the United States for EMF exposure. A few states have some type of electric field guideline and two states have a magnetic field standard. These guidelines are summarized in Table II. Please note that the state of Oregon specifies that the Electric Field must not exceed 9kV/m within the ROW.

The International Commission on Non-Ionizing Radiation Protection has published "Guidelines for Limiting Exposure to Time Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz) in the April 1998 issue of Health Physics. The guidelines relating to the general public are summarized in Table III.

TABLE II STATE REGULATIONS THAT LIMIT FIELD STRENGTHS ON TRANSMISSION LINE RIGHTS-OF-WAY	
State	Field Limit
Montana	1kV/m at edge of right-of-way in residential areas
Minnesota	8kV/m maximum in right-of-way
New Jersey	3kV/m at edge of right-of-way
New York	1.6 kV/m at edge of right-of-way; 11.8kV on the right-of-way
North Dakota	9kV/m maximum in right-of-way
Oregon	9kV/m maximum in right-of-way
Florida	10kV/m maximum for 500kV lines in right-of-way; 2kV/m maximum for 500kV lies at edge of right-of-way; 8kV/m maximum for 230kV and smaller lines in right-of-way; 3kV/m maximum for 230kV and smaller lines at edge of right-of-way; 200 mG for 500kV lines at edge of right-of-way; 250 mG for double circuit 500kV lines at edge of right-of-way; and 150 mG for 230kV and smaller lines at edge of right-of-way

TABLE III IRPA GENERAL PUBLIC EXPOSURE GUIDELINES		
Exposure	Electric Field	Magnetic Field
Up to 24 hours/day	4.2k V/m	830 mG

IV RESULTS

Tables IV and V show the electric fields, magnetic fields, and radio noise for the existing and the proposed lines from Boardman to Slatt and Carty to Slatt for single circuit and double circuit configurations. The calculated maximum electric field is 7.705kV/Meter for Case 3 and Case 4 within the 700 foot ROW for the existing and new single circuits, with the EMF cut at the New Switchyard near Boardman Plant. The calculated maximum electric field is 8.547kV/Meter for Case 6 within the joint ROW at the Slatt Substation.

The calculated maximum magnetic field is 204.6 mGauss for Case 2 within the 700 foot ROW for the existing and new single circuits, with the EMF cut at the New Switchyard near Boardman Plant. The calculated maximum magnetic field is 313.7 mGauss for Case 6 within the joint ROW at the Slatt Substation.

The state of Oregon does not specify the guidelines regarding the maximum magnetic field strength on the ROW. However, the calculated maximum electric field of 8.547kV /Meter is below the 9kV/Meter electric field strength within the ROW as required by the state of Oregon (OAR 345-024-0090).

The calculated maximum Radio Noise within the ROW is 85dB during wet weather conditions. However, the potential for interference will depend, among other things, on the signal strength, and transmission line noise level in the signal bandwidth. A signal-to-noise ratio (SNR) can be calculated and reception can be evaluated using the reception guidelines of the Federal Communications Commission (FCC). In general, the 500-kV transmission line should not cause radio interference beyond the edge of the ROW in either fair or wet weather conditions due to corona noise. However, the extent of interference cannot be evaluated without knowledge of local signal strengths to facilitate calculation of anticipated SNRs.

Table IV. EMF cuts at new 500-kV Switchyard near Boardman Plant

Case Designation	South Edge ROW	Maximum within ROW	North Edge ROW	200' North of Northernmost Existing C/L
Electric Field (kV/Meter)				
Case 1	0.019	7.695	0.327	0.170
Case 2	0.019	7.695	0.327	0.170
Case 3	0.063	7.705	0.351	0.193
Case 4	0.063	7.705	0.351	0.193
Case 6	0.033	7.680	0.307	0.153
Magnetic Field (milliGauss)				
Case 1	0.5	110.4	7.0	4.0
Case 2	1.0	204.6	12.9	7.4
Case 3	1.7	99.2	7.6	4.6
Case 4	2.4	141.8	10.9	6.6
Case 6	0.7	96.3	6.2	3.6
Radio Noise during Fair Weather (dB)				
Case 1	30.0	66.1	43.5	40.3
Case 2	30.0	66.1	43.5	40.3
Case 3	34.2	66.3	43.3	40.2
Case 4	34.2	66.3	43.3	40.2
Case 6	39.9	68.2	43.4	40.3
Radio Noise during Rain (dB)				
Case 1	47.0	83.1	60.5	57.3
Case 2	47.0	83.1	60.5	57.3
Case 3	51.2	83.3	60.3	57.2
Case 4	51.2	83.3	60.3	57.2
Case 6	56.9	85.2	60.4	57.3

Table V. EMF cuts near new 500-kV Switchyard at Slatt Substation

Case Designation	South Edge ROW	Maximum within ROW	North Edge ROW	200' North of Northernmost Existing C/L
Electric Field (kV/Meter)				
Case 1	0.050	8.547	0.605	0.040
Case 2	0.050	8.547	0.605	0.040
Case 3	0.105	8.546	0.603	0.043
Case 4	0.105	8.546	0.603	0.043
Case 6	0.053	8.548	0.607	0.038
Magnetic Field (milliGauss)				
Case 1	2.7	313.6	20.3	5.1
Case 2	3.3	313.0	20.5	5.2
Case 3	4.2	313.3	20.4	5.2
Case 4	5.2	312.9	20.6	5.3
Case 6	2.9	313.7	20.3	5.0
Radio Noise during Fair Weather (dB)				
Case 1	31.7	67.7	36.6	30.7
Case 2	31.7	67.7	36.6	30.7
Case 3	35.7	67.7	36.6	30.6
Case 4	35.7	67.7	36.6	30.6
Case 6	41.6	68.2	36.6	30.7
Radio Noise during Rain (dB)				
Case 1	48.7	84.7	53.6	47.7
Case 2	48.7	84.7	53.6	47.7
Case 3	52.7	84.7	53.6	47.6
Case 4	52.7	84.7	53.6	47.6
Case 6	58.6	85.2	53.6	47.7

V EMF HEALTH EFFECTS

The issue of health effects due to exposure to EMF is always a subject of discussion. EMF exposure in residential and occupational situations has been studied for a wide variety of sources, including transmission lines, distribution lines, household wiring, electric appliances, electrically operated equipment or machinery, and others.

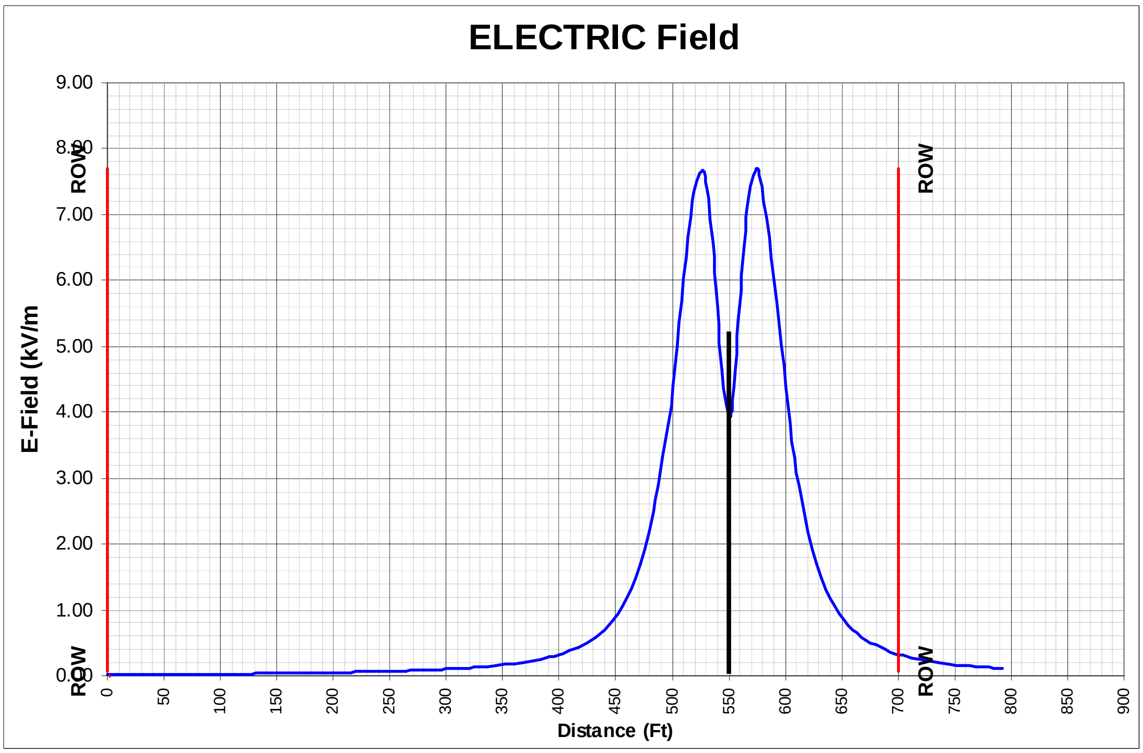
A number of studies over the last 20 years or so generally have found no conclusive evidence of harmful effects from typical power line and substation EMF. Some studies during this period did report the potential for harmful effects. The evidence for such an association is inconclusive, and the most recent independent comprehensive review of the scientific literature by the National Academy of Sciences, *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields* (1997), reached the following conclusions:

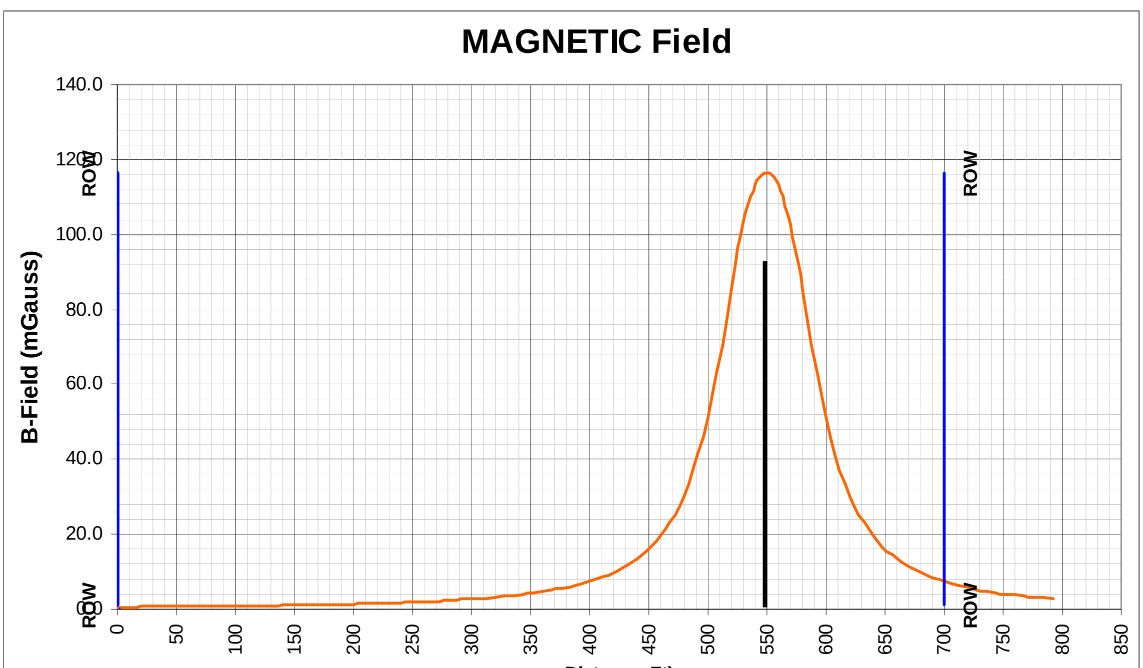
> ***"Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.***
>
> ***The committee reviewed residential exposure levels to electric and magnetic fields, evaluated the available epidemiological studies, and examined laboratory investigations that used cells, isolated tissues, and animals. At exposure levels well above those normally encountered in residences, electric and magnetic fields can produce biologic effects (promotion of bone healing is an example), but these effects do not provide a consistent picture of a relationship between the biologic effects of these fields and health hazards. An association between residential wiring configurations (called wire codes) and childhood leukemia persists in multiple studies, although the causative factor responsible for that statistical association has not been identified. No evidence links contemporary measurements of magnetic-field levels to childhood leukemia."***

APPENDIX

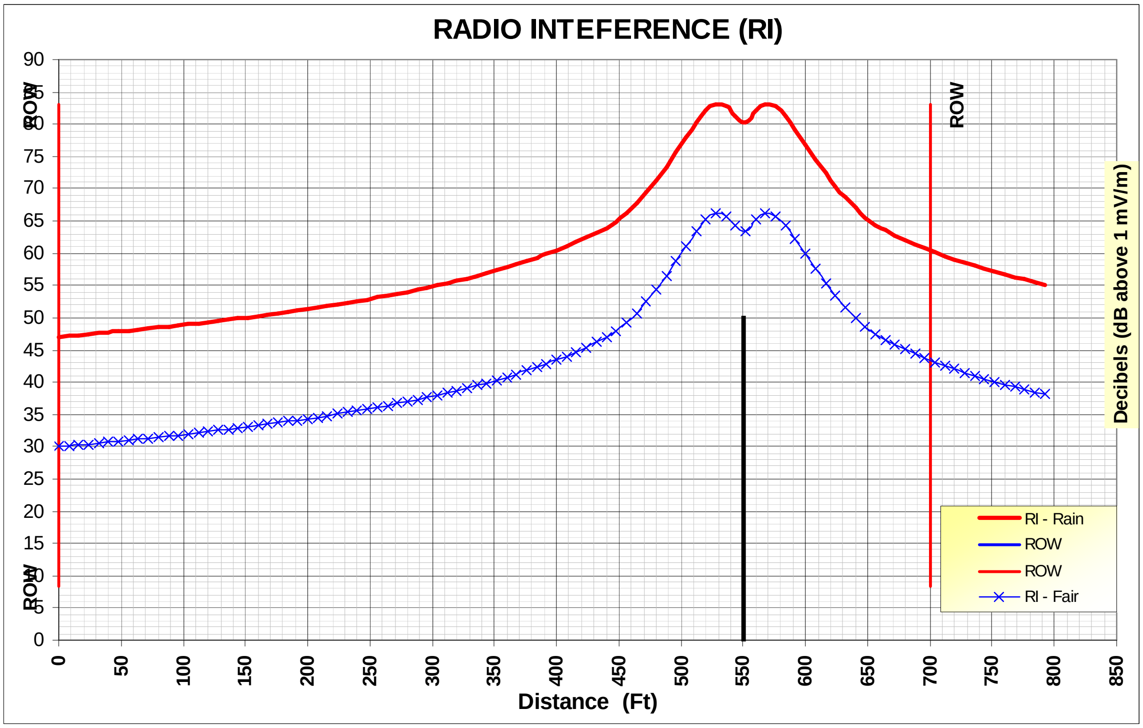
A. Electric and Magnetic Field Plots

Case #1 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

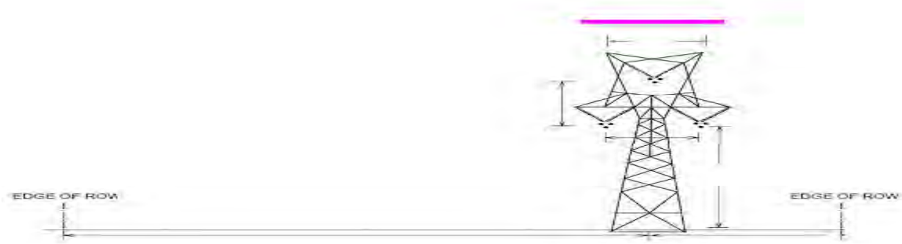


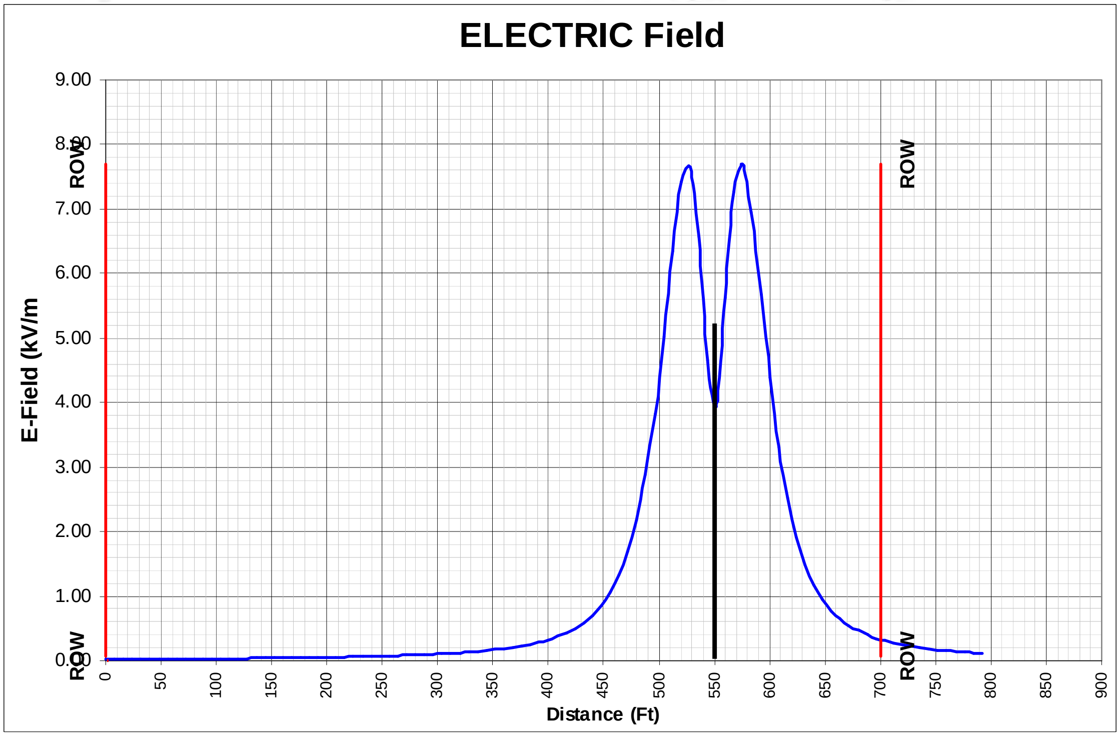


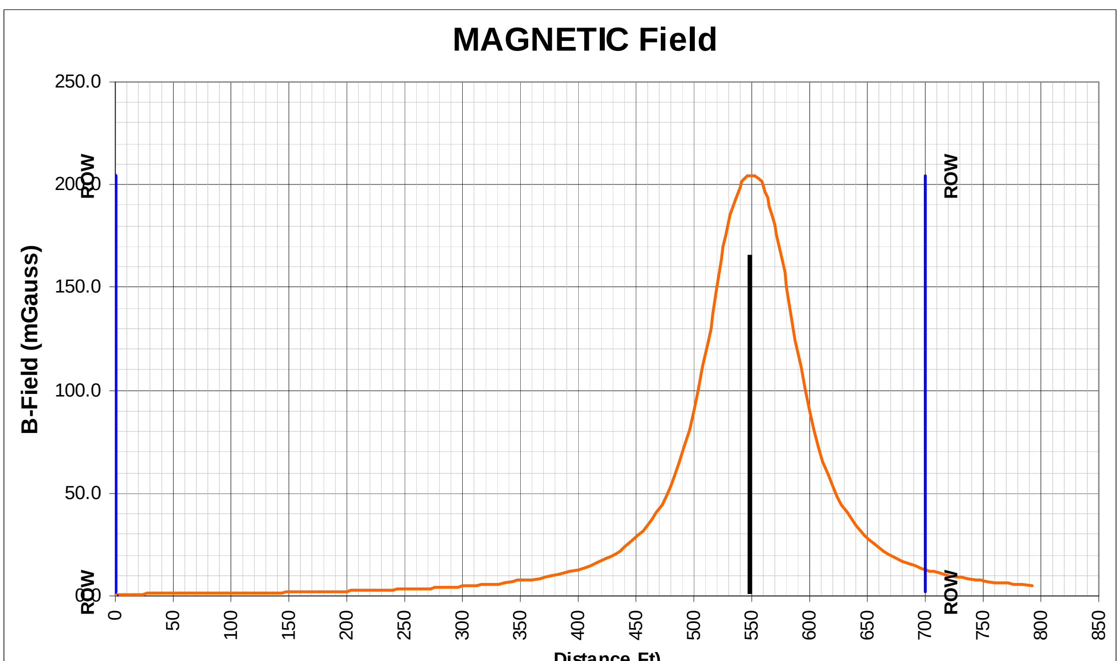
Case #1 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)



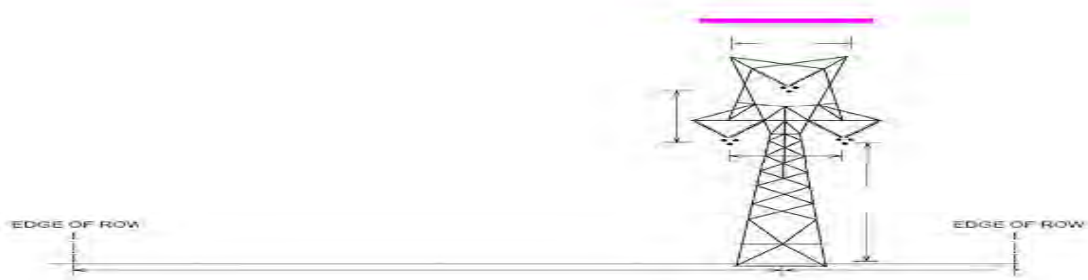
Case #2 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

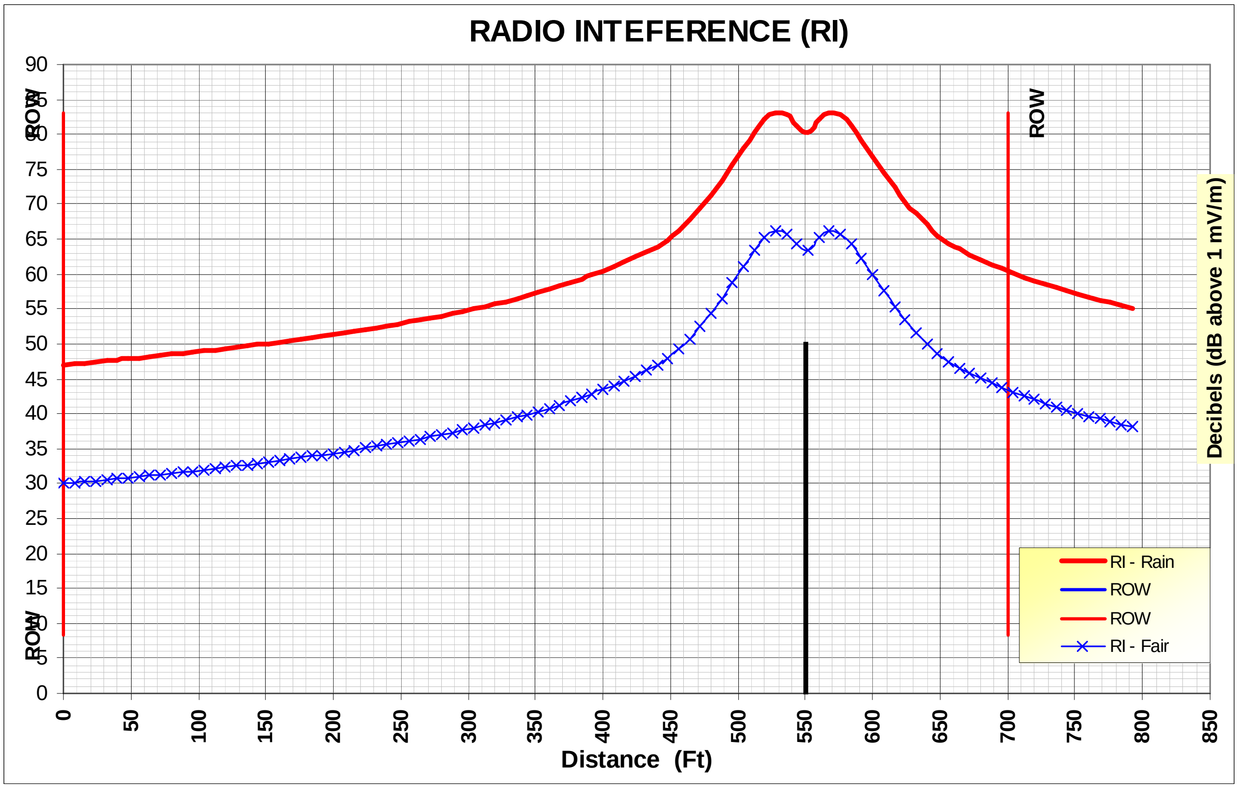




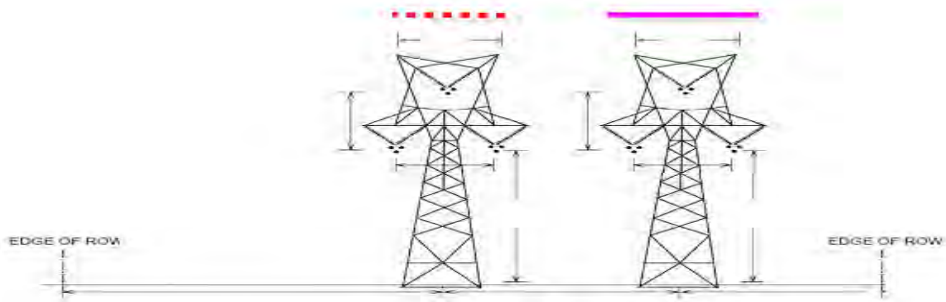


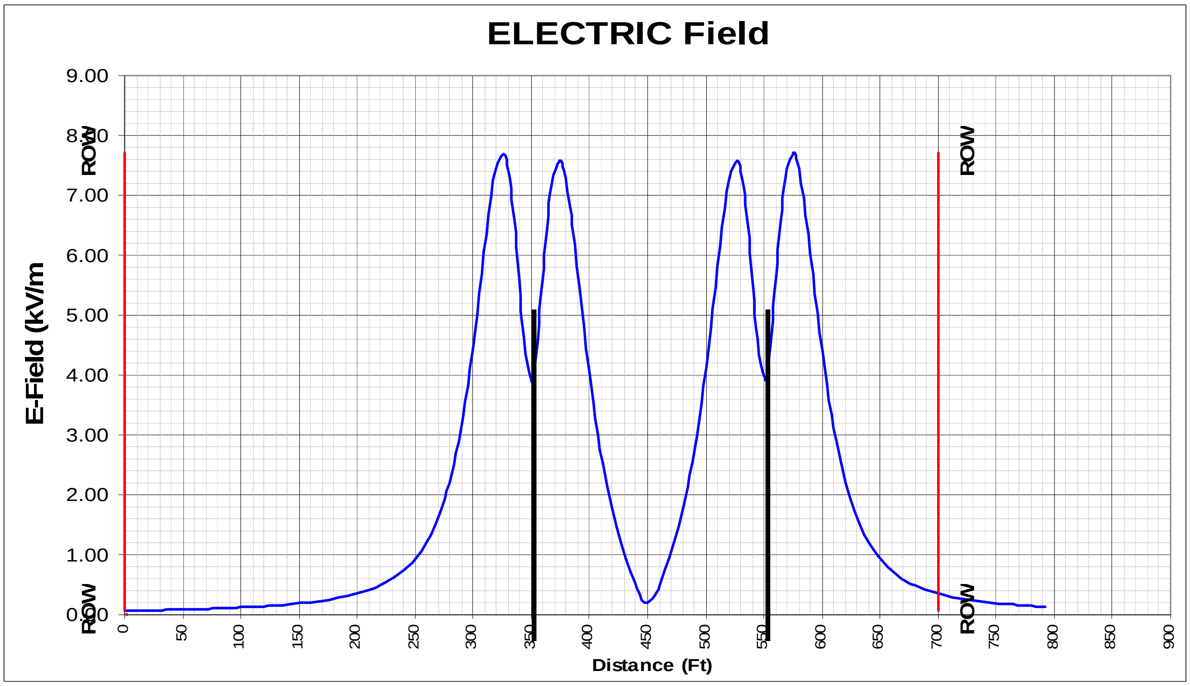
Case #2 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

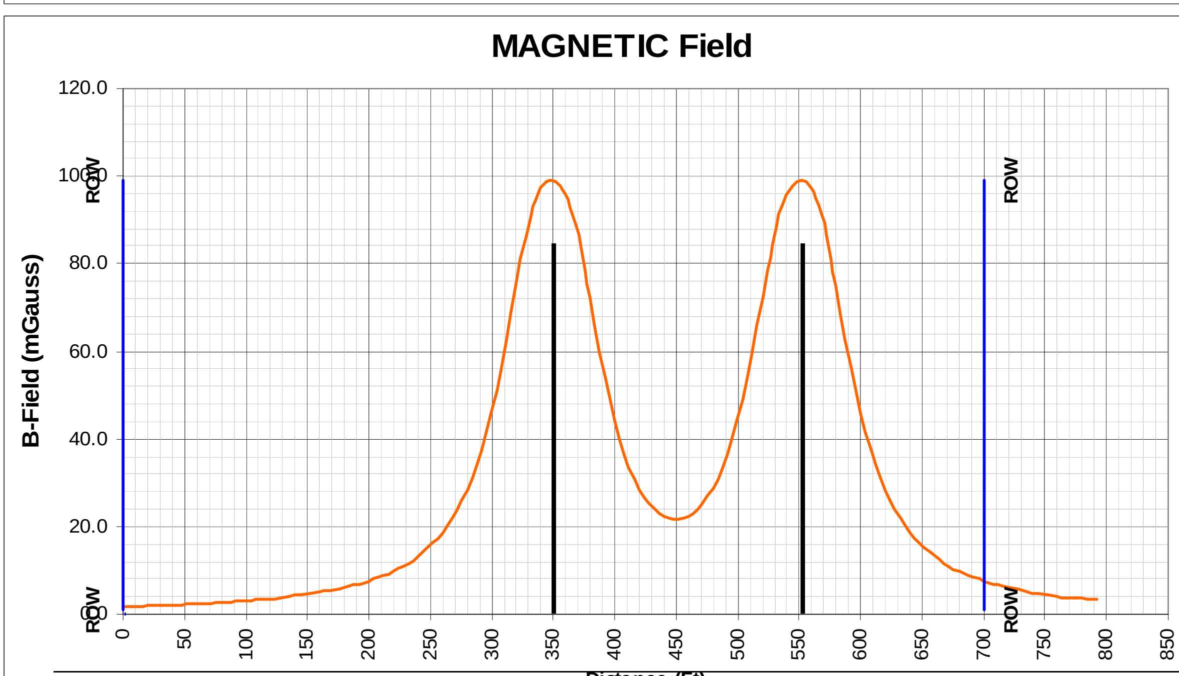




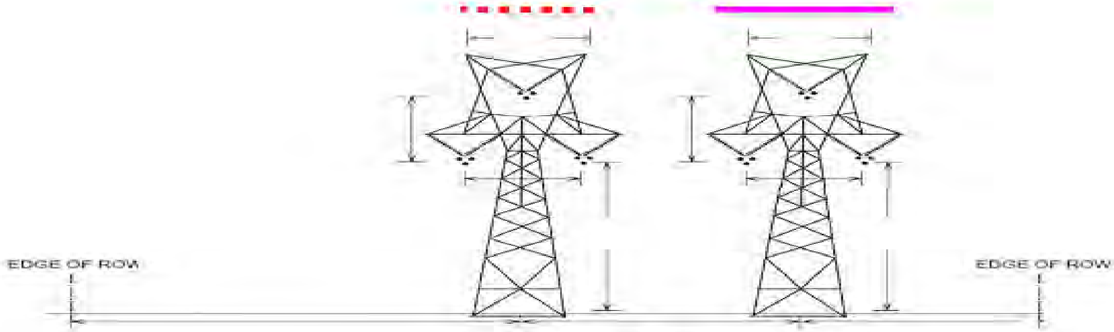
Case #3 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

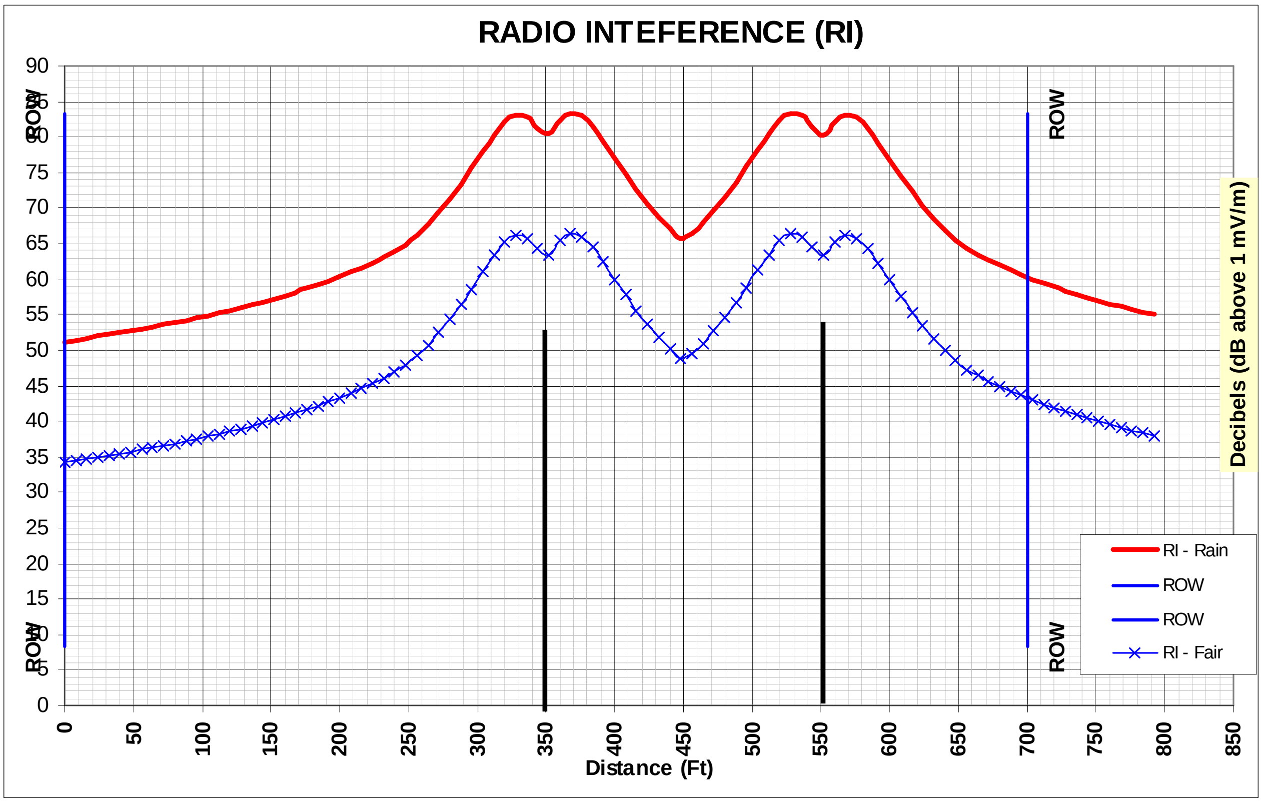




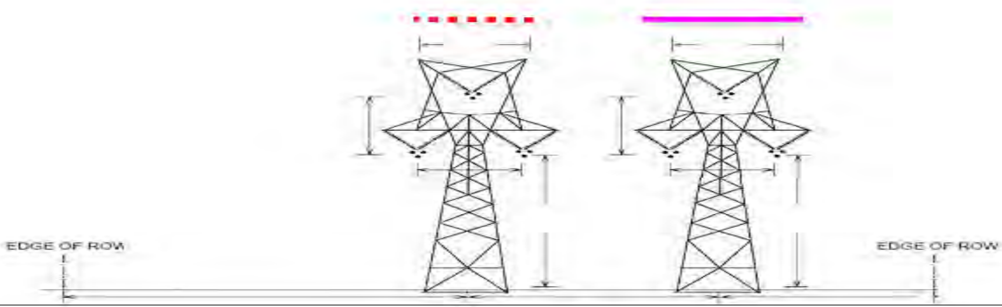


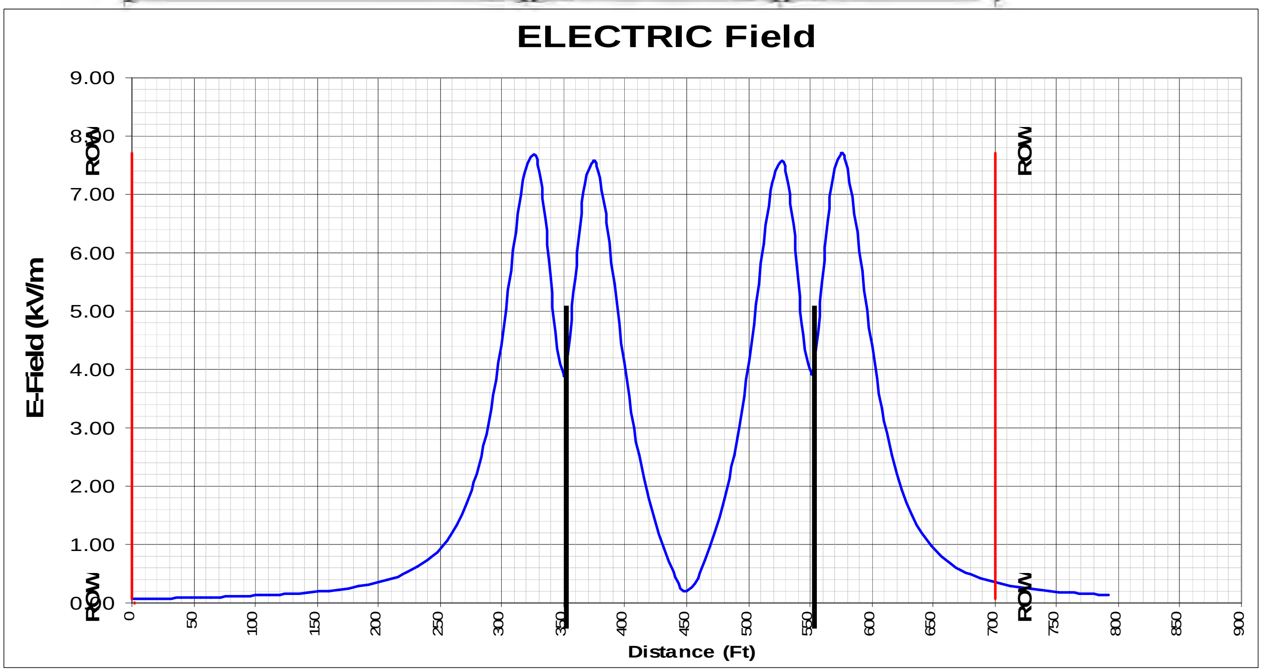
Case #3 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

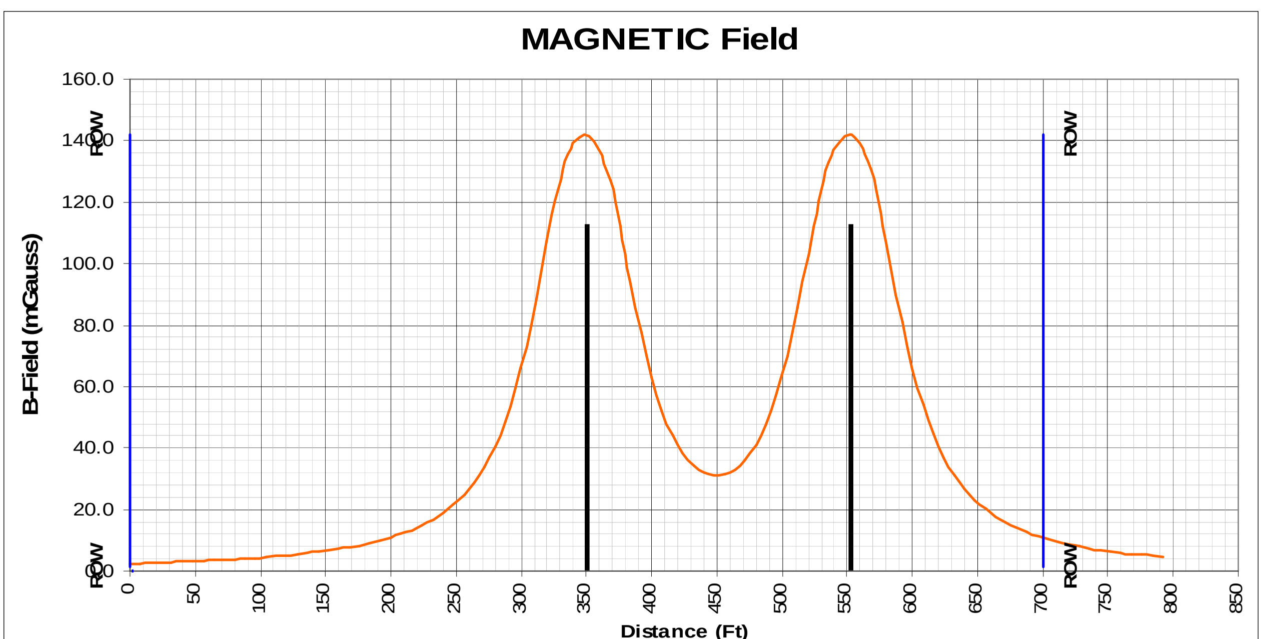




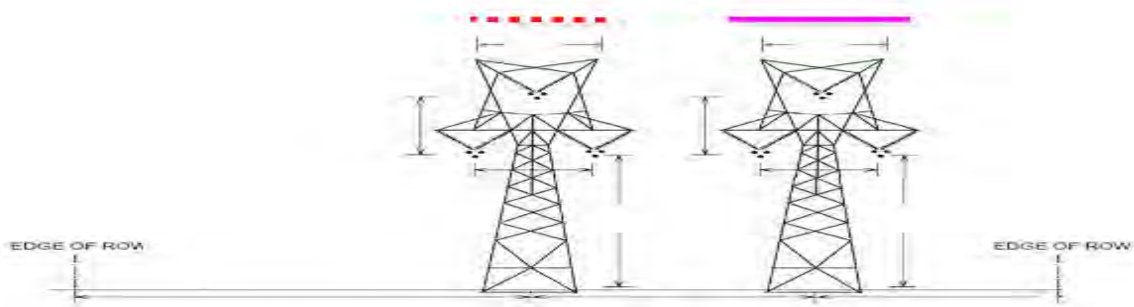
Case #4 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

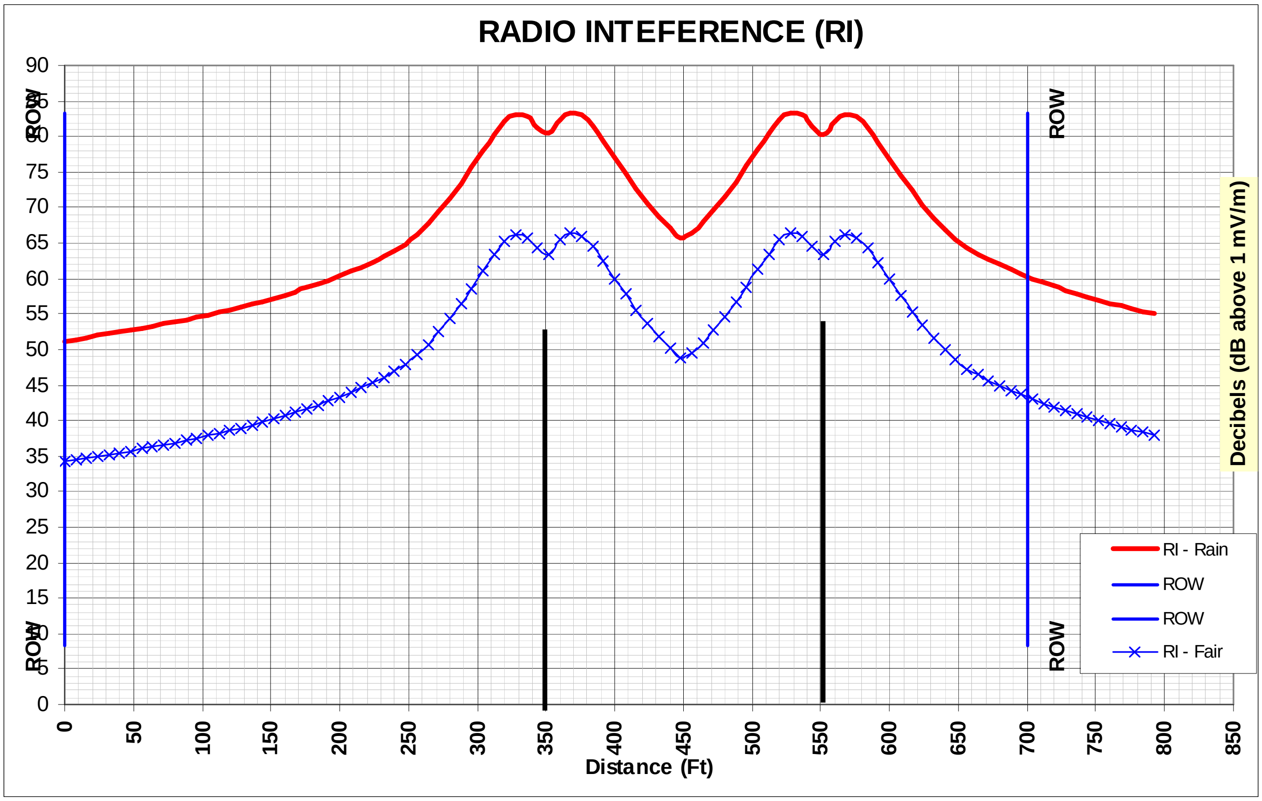




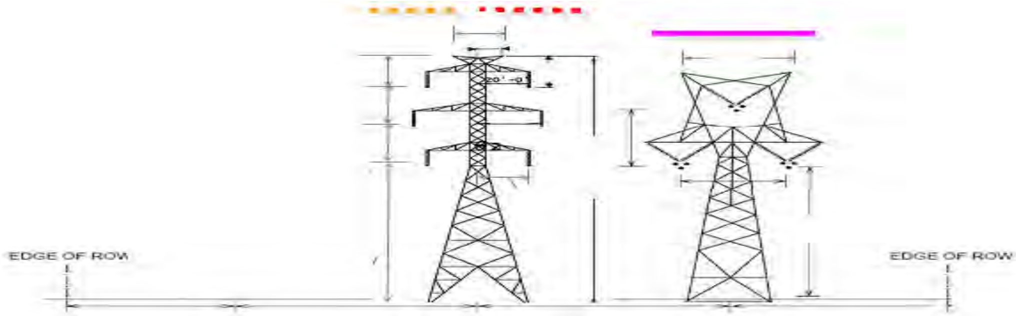


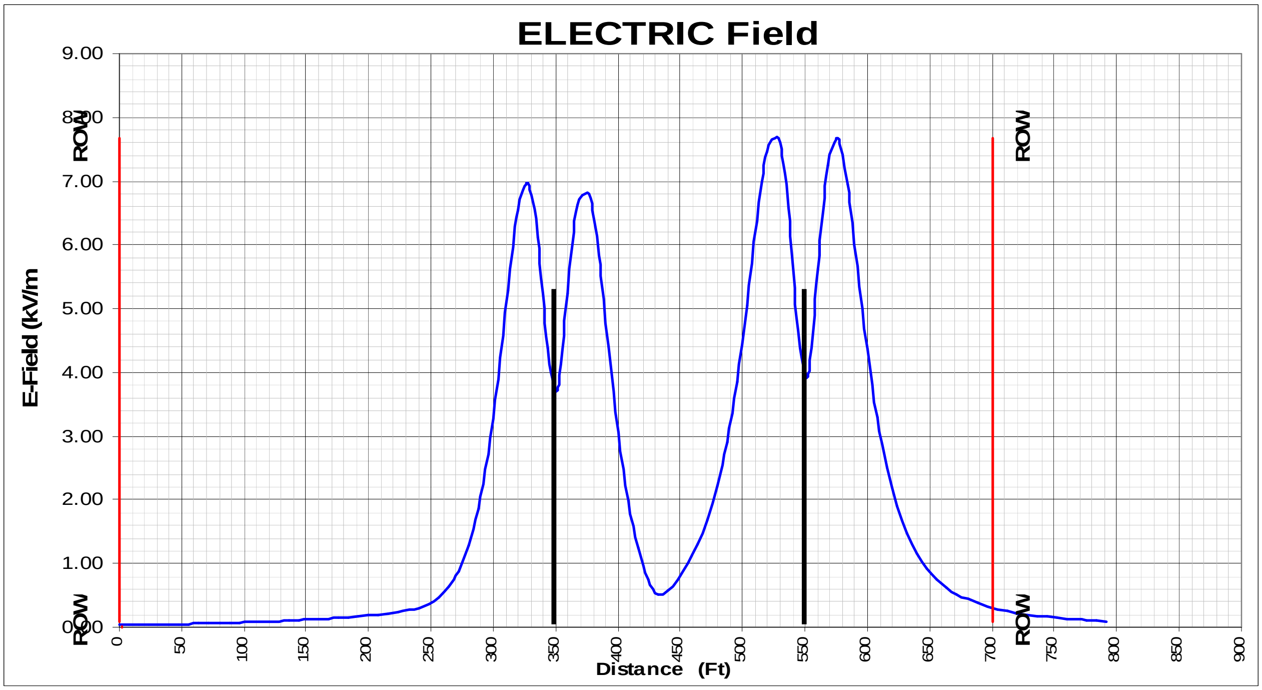
Case #4 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

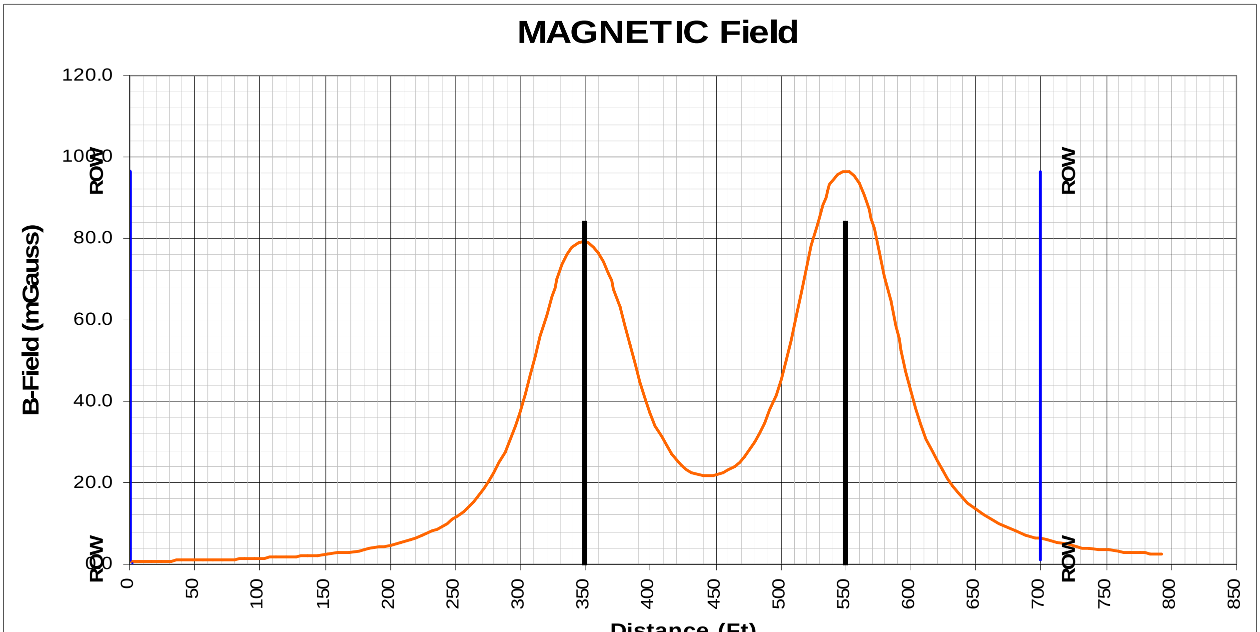




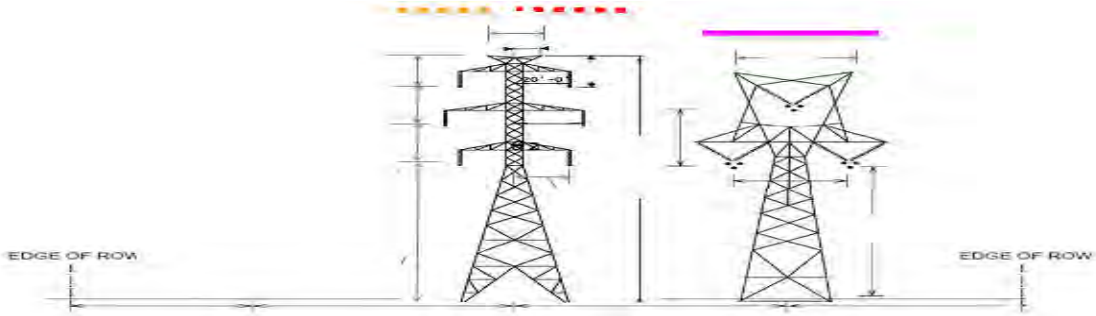
Case #6 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

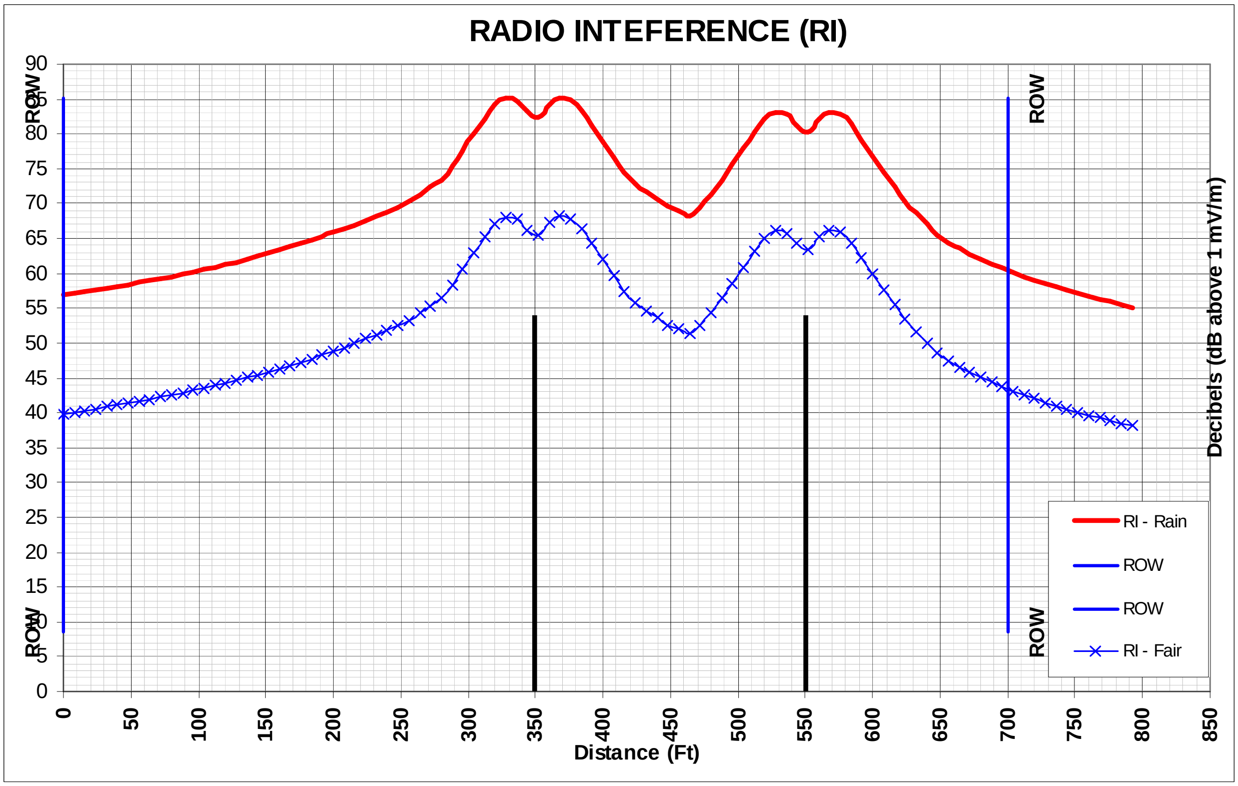




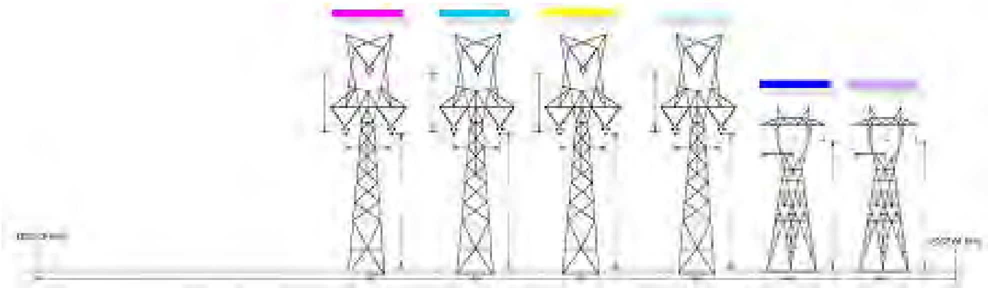


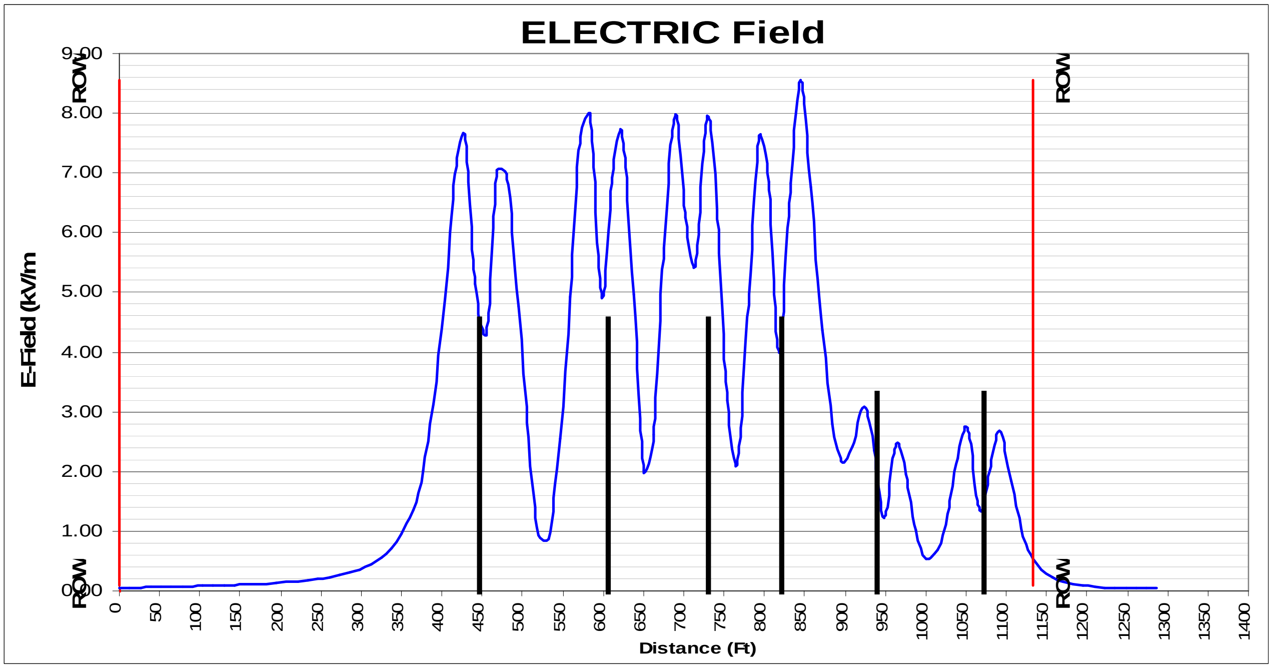
Case #6 ROW EMF cut @ new Switchyard near Boardman Plant (Looking W)

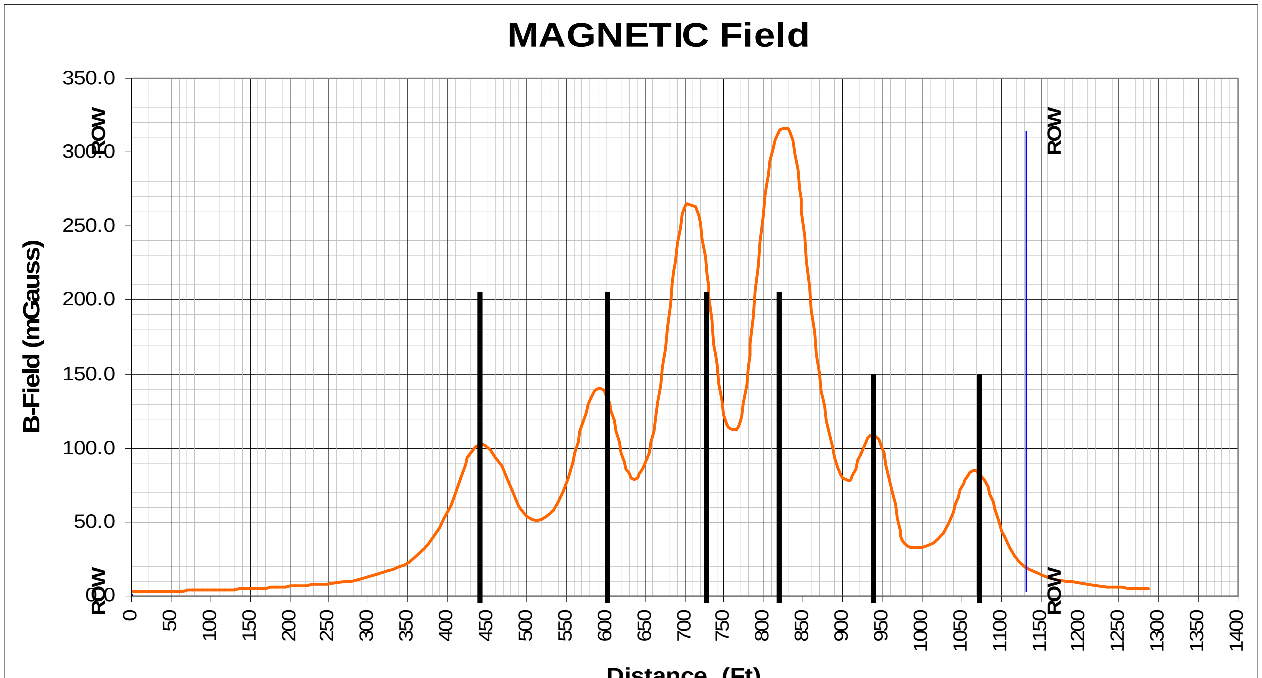




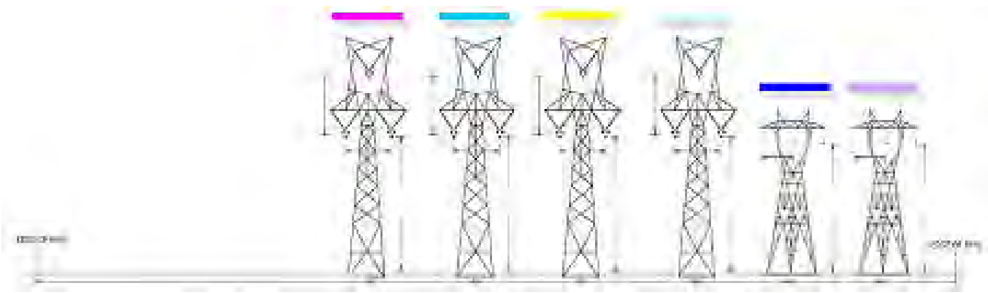
Case #1 ROW EMF cut @ Slatt Sub (Looking SW)

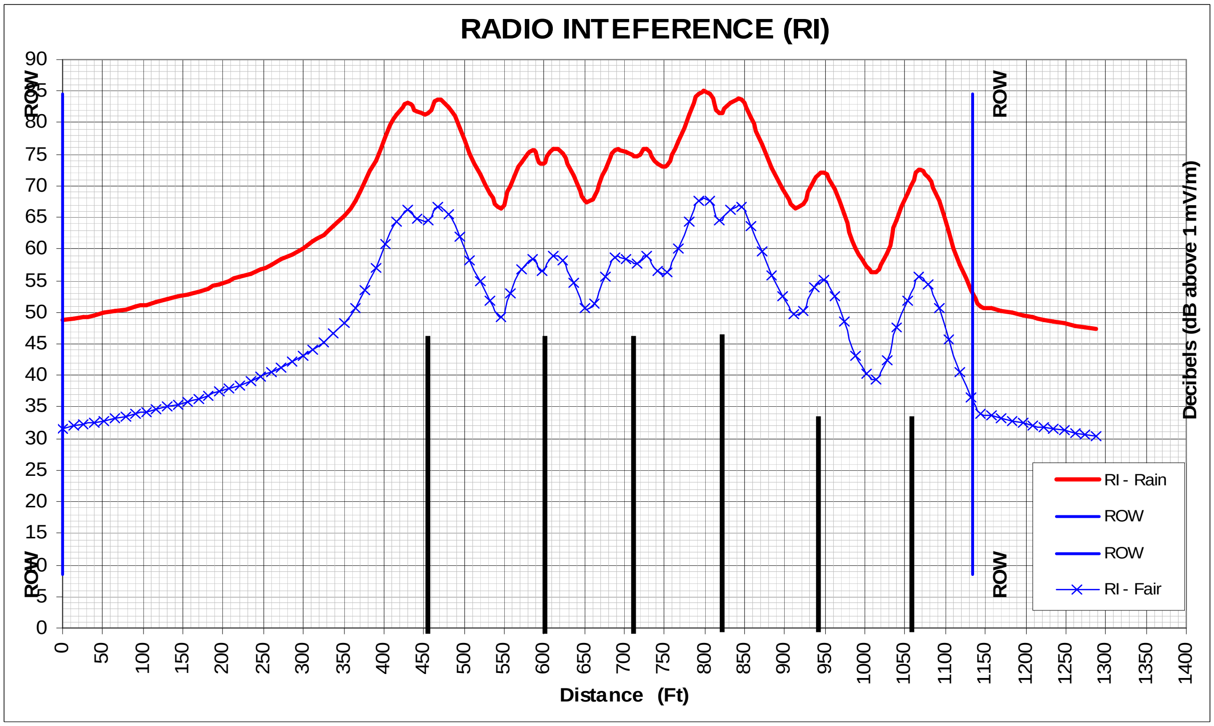




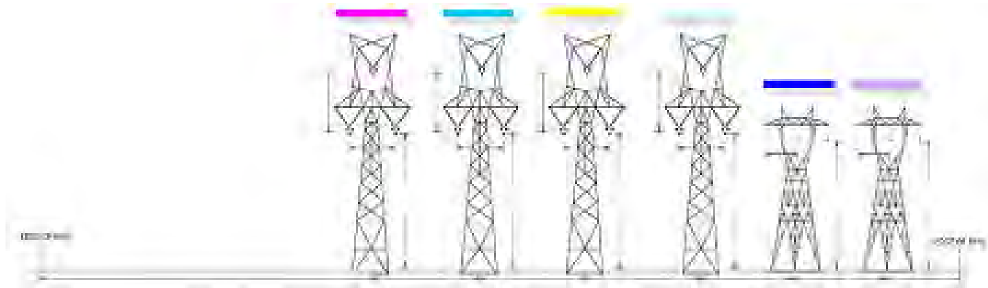


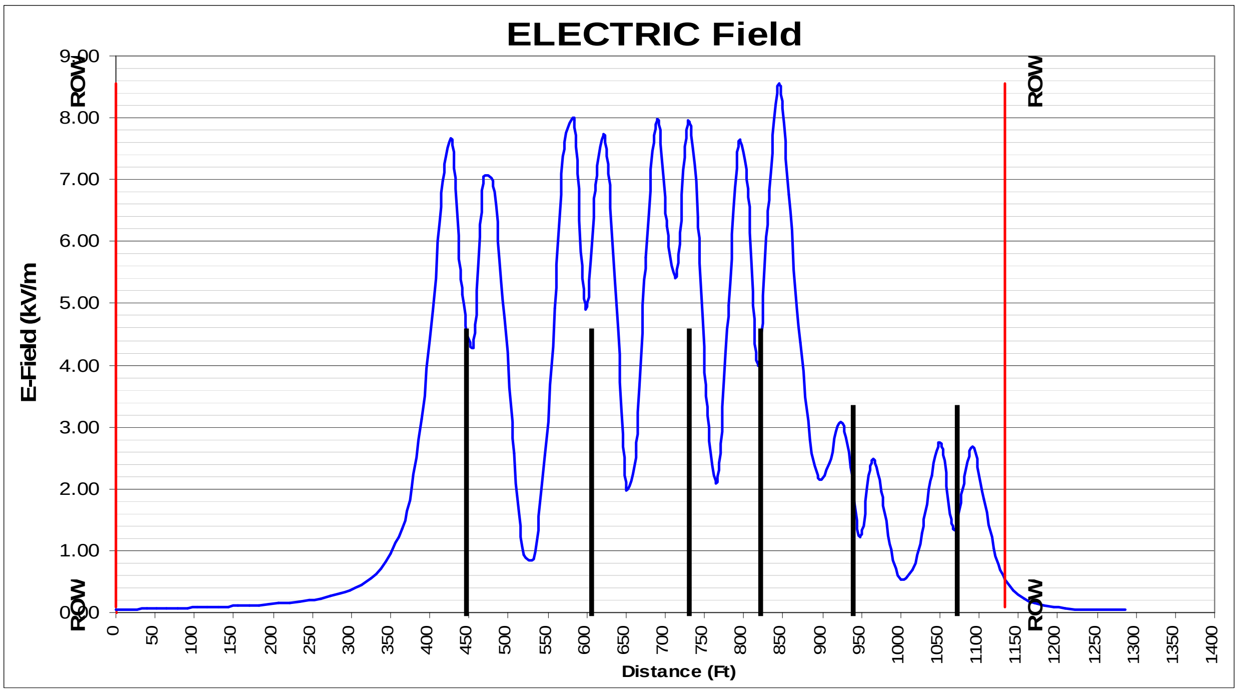
Case #1 ROW EMF cut @ Slatt Sub (Looking SW)

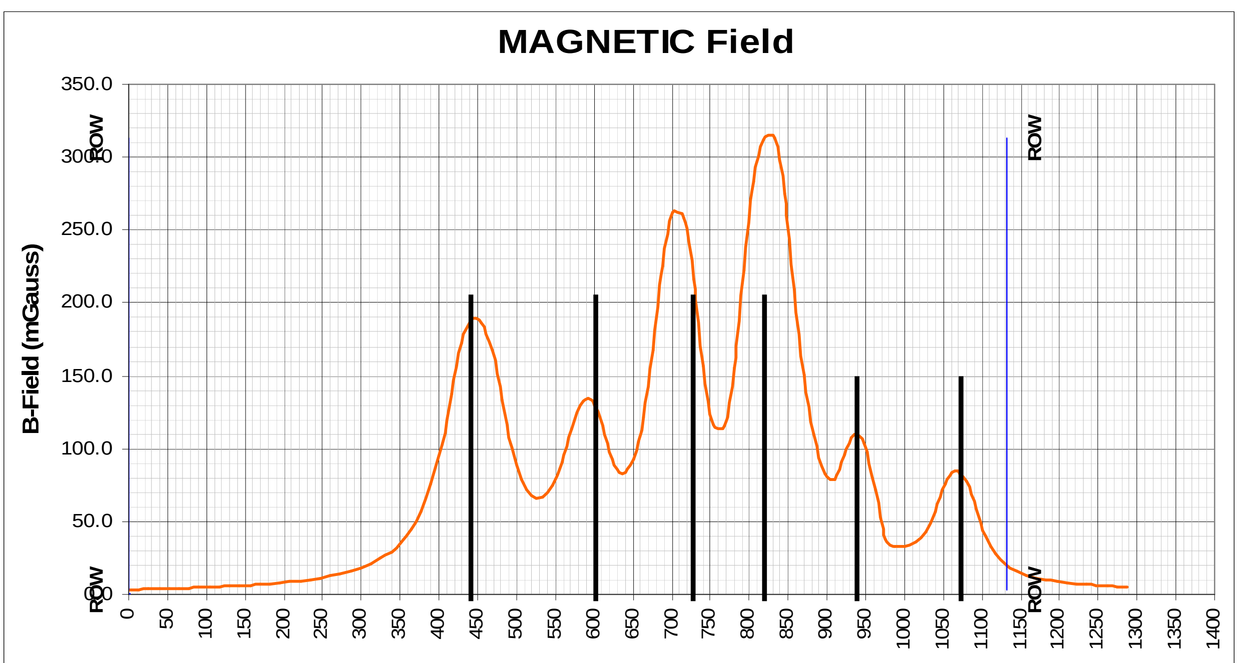




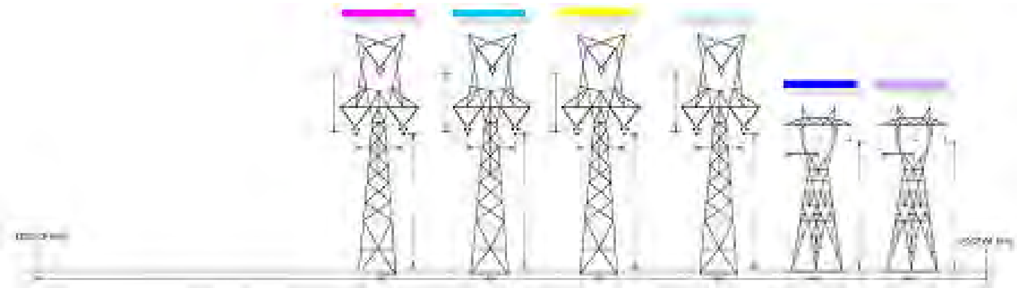
Case #2 ROW EMF cut @ Slatt Sub (Looking SW)

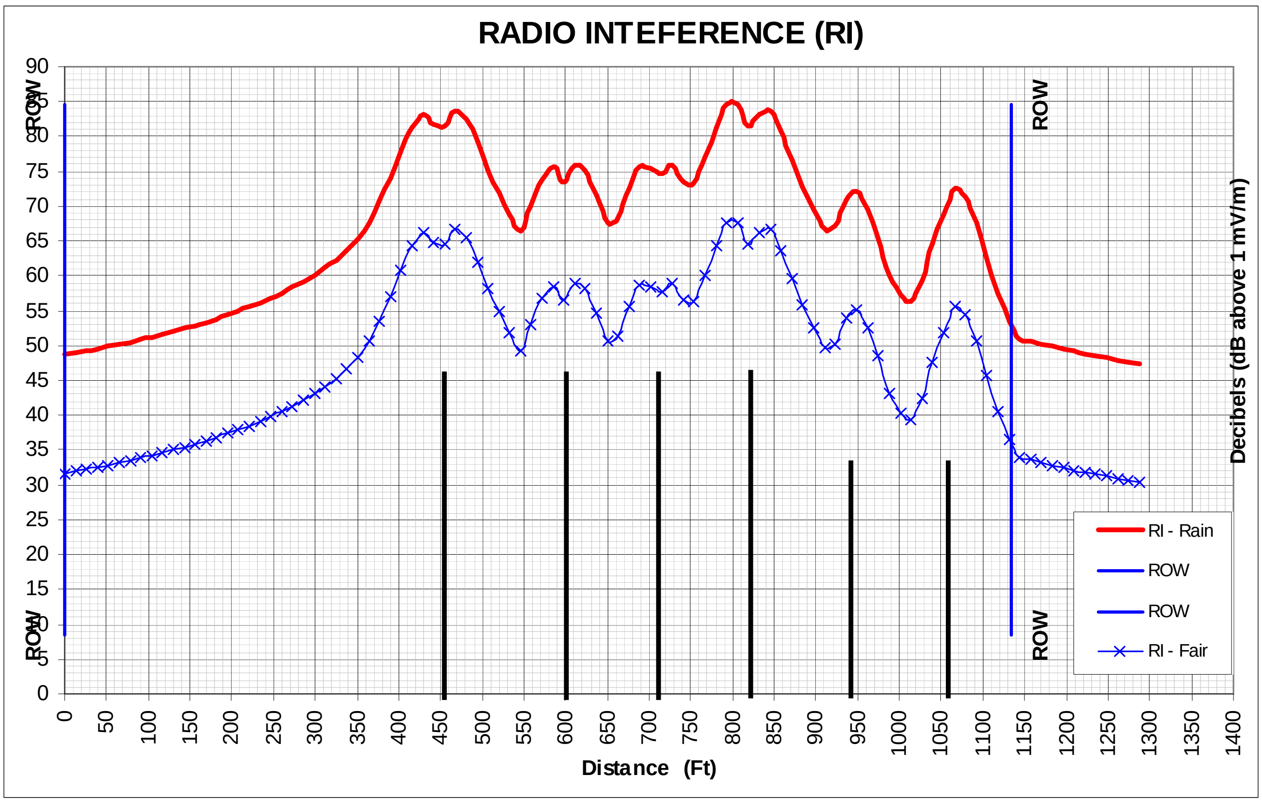




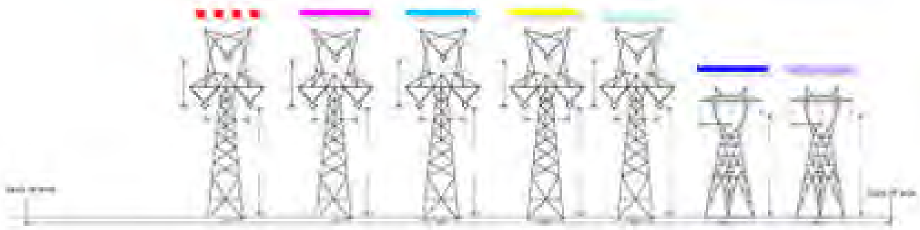


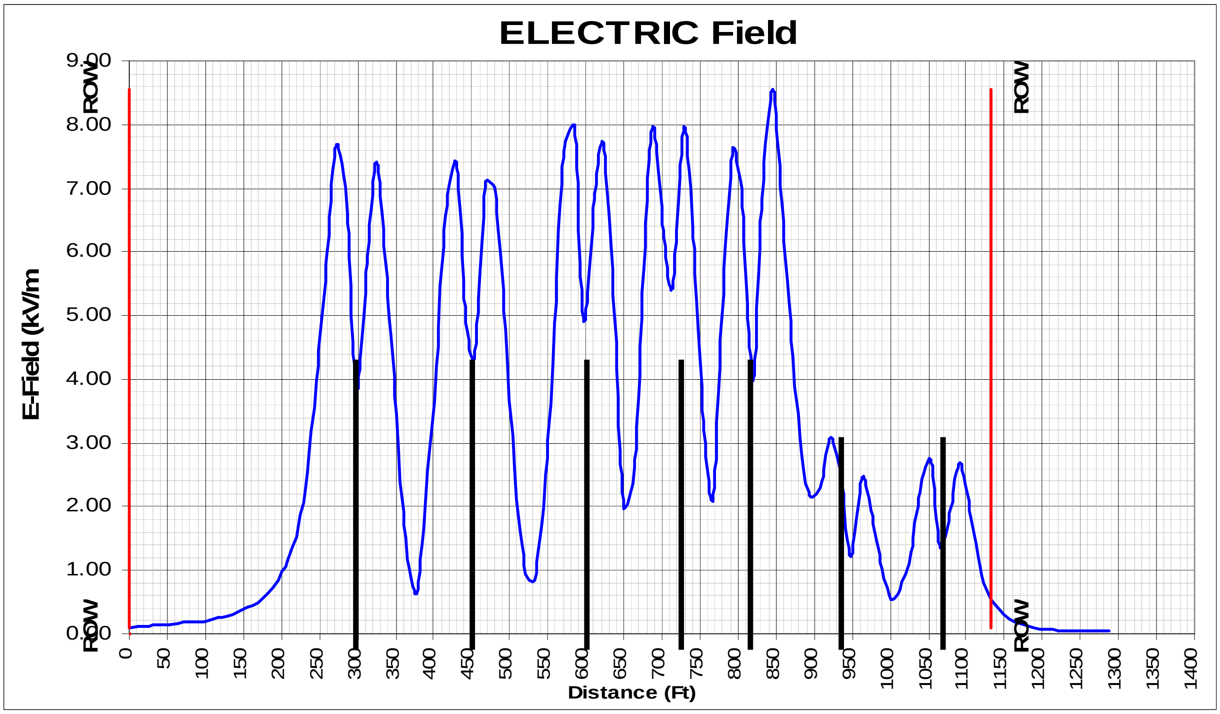
Case #2 ROW EMF cut @ Slatt Sub (Looking SW)

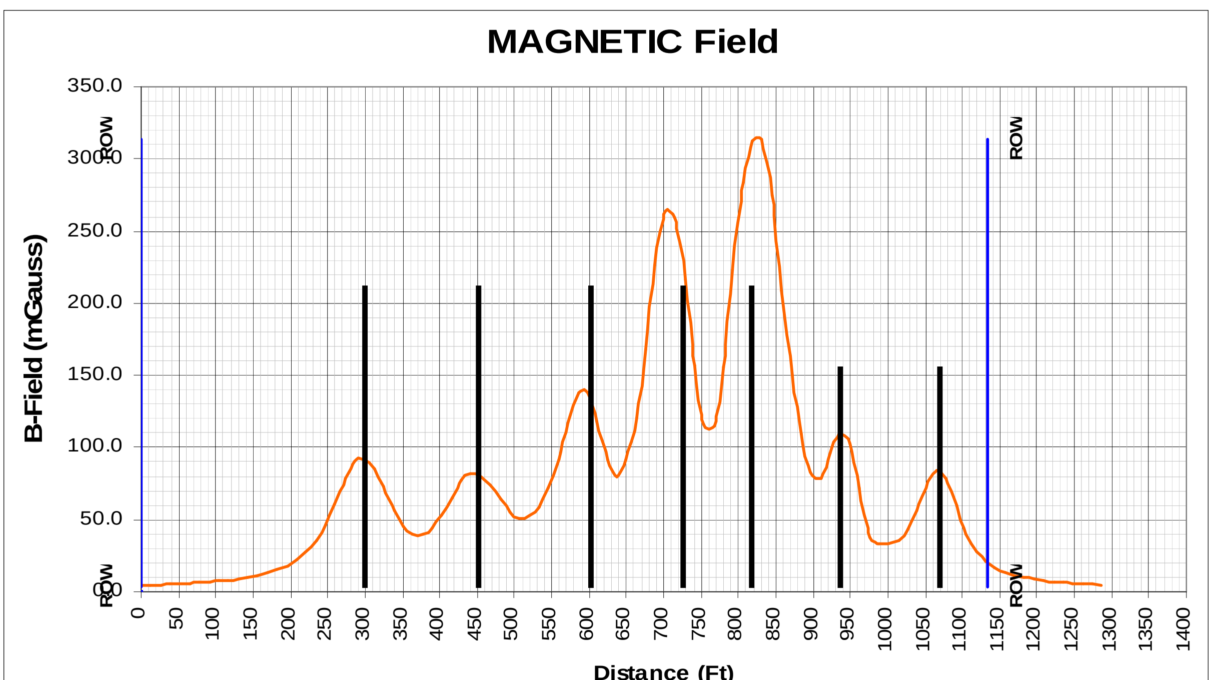




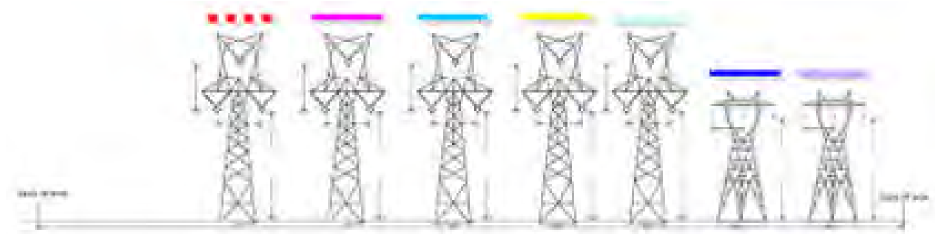
Case #3 ROW EMF cut @ Slatt Sub (Looking SW)

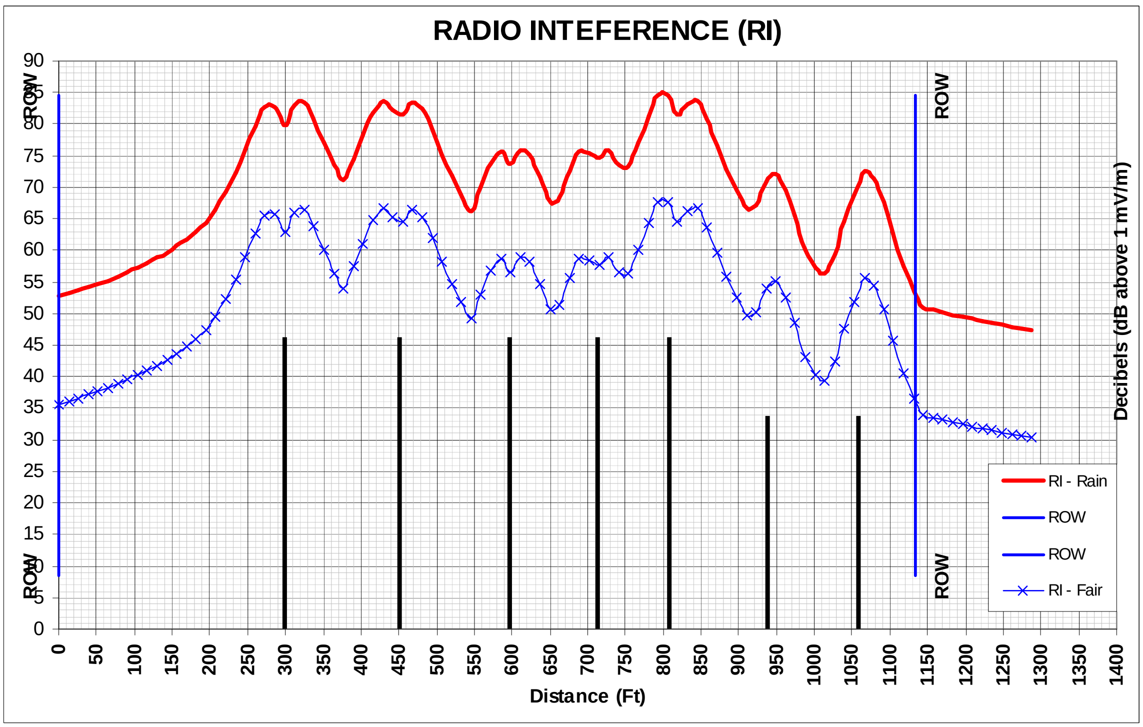




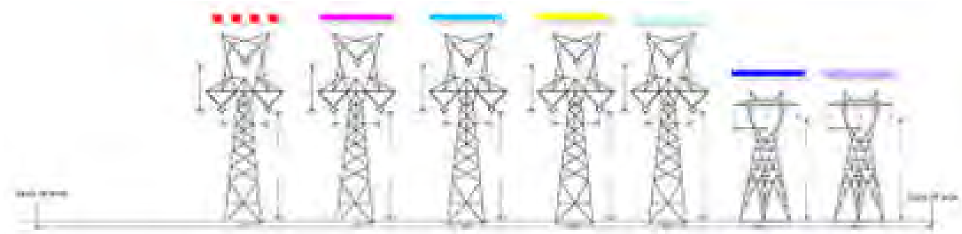


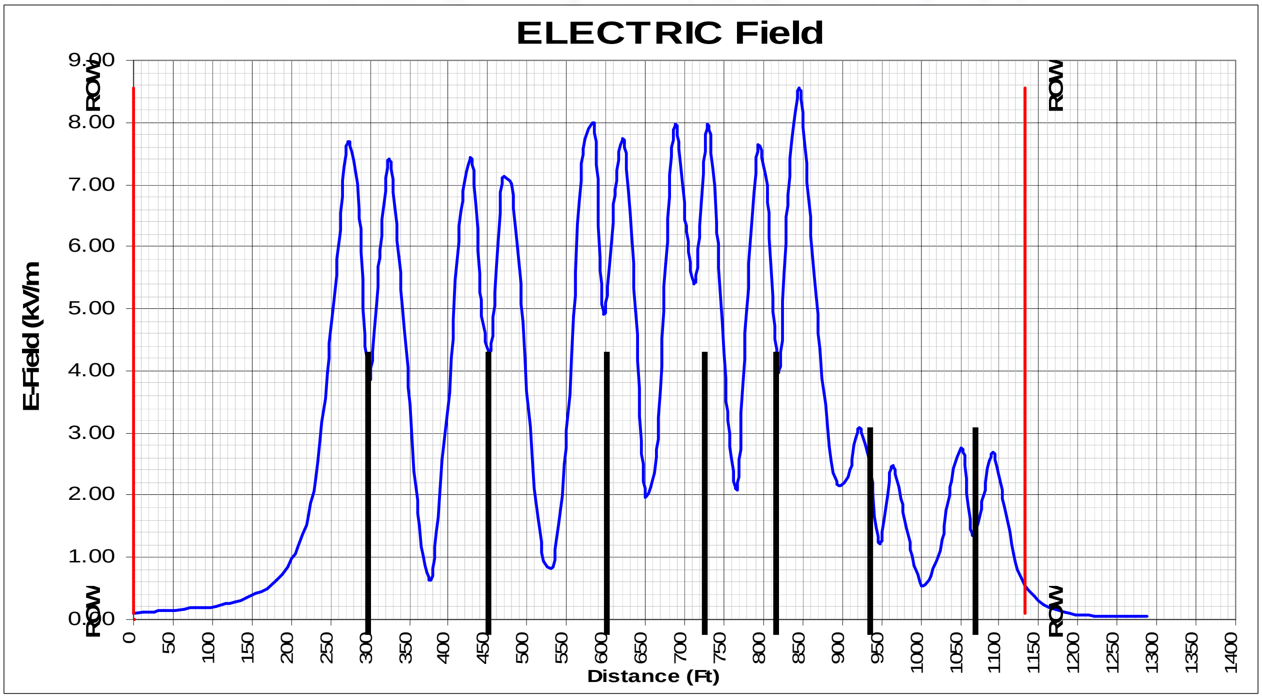
Case #3 ROW EMF cut @ Slatt Sub (Looking SW)

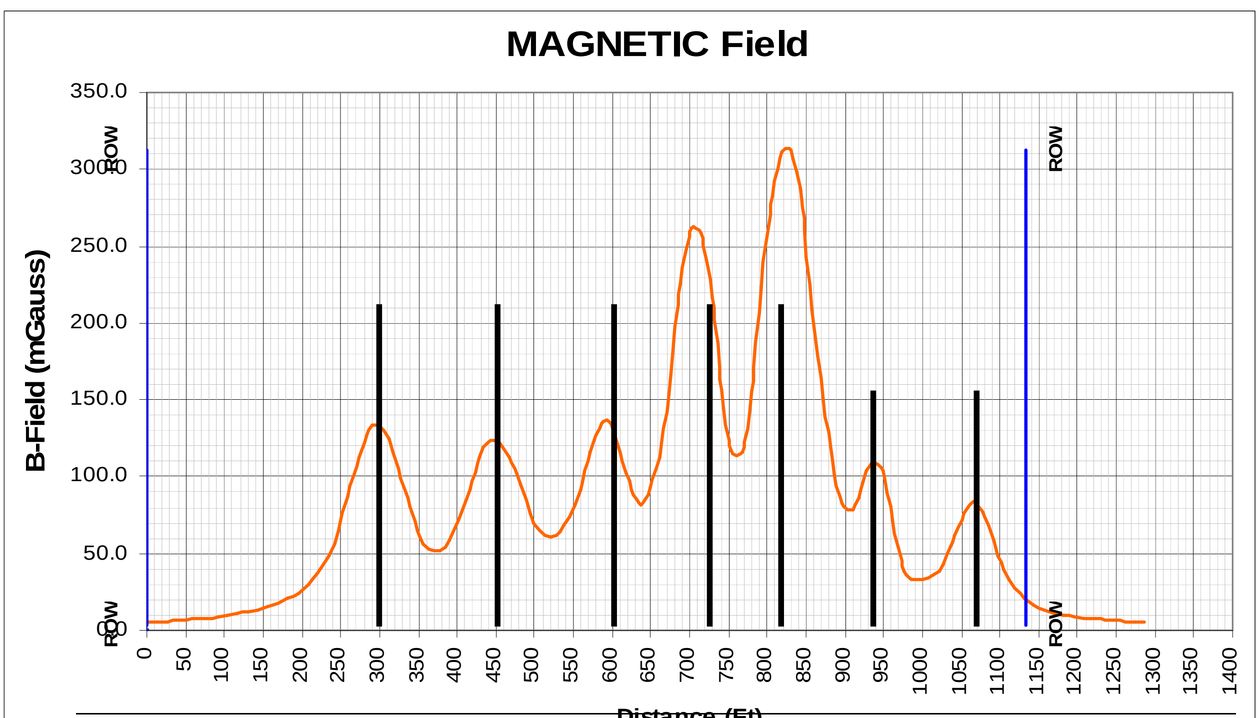




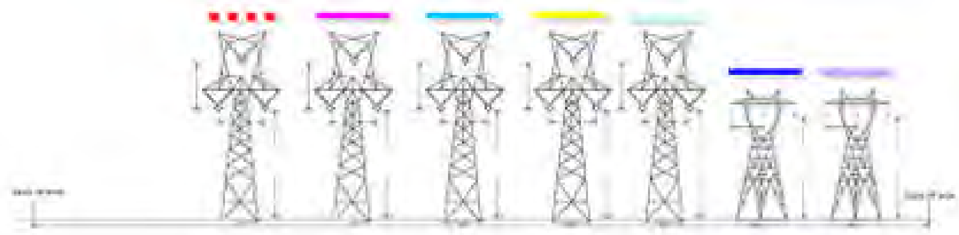
Case #4 ROW EMF cut @ Slatt Sub (Looking SW)

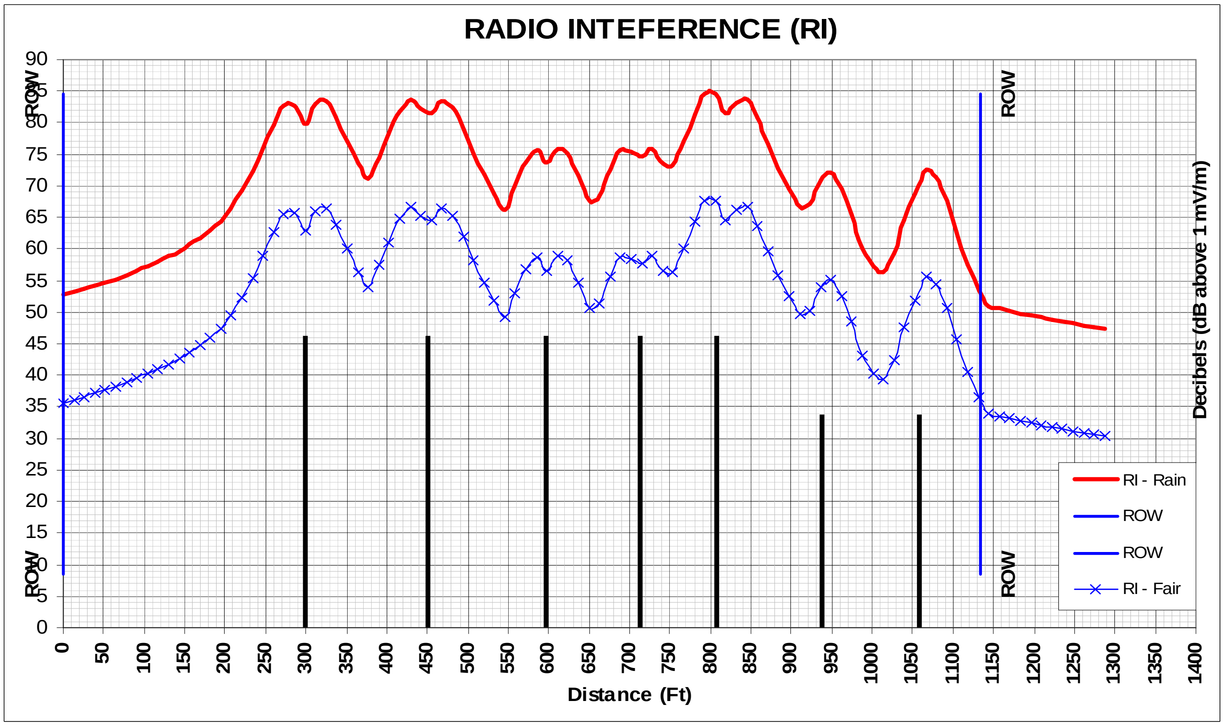




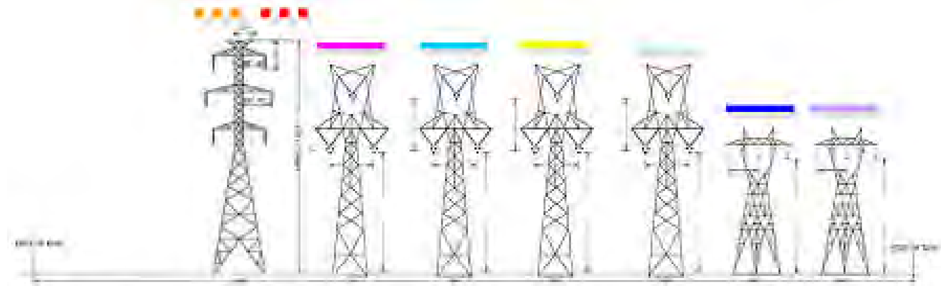


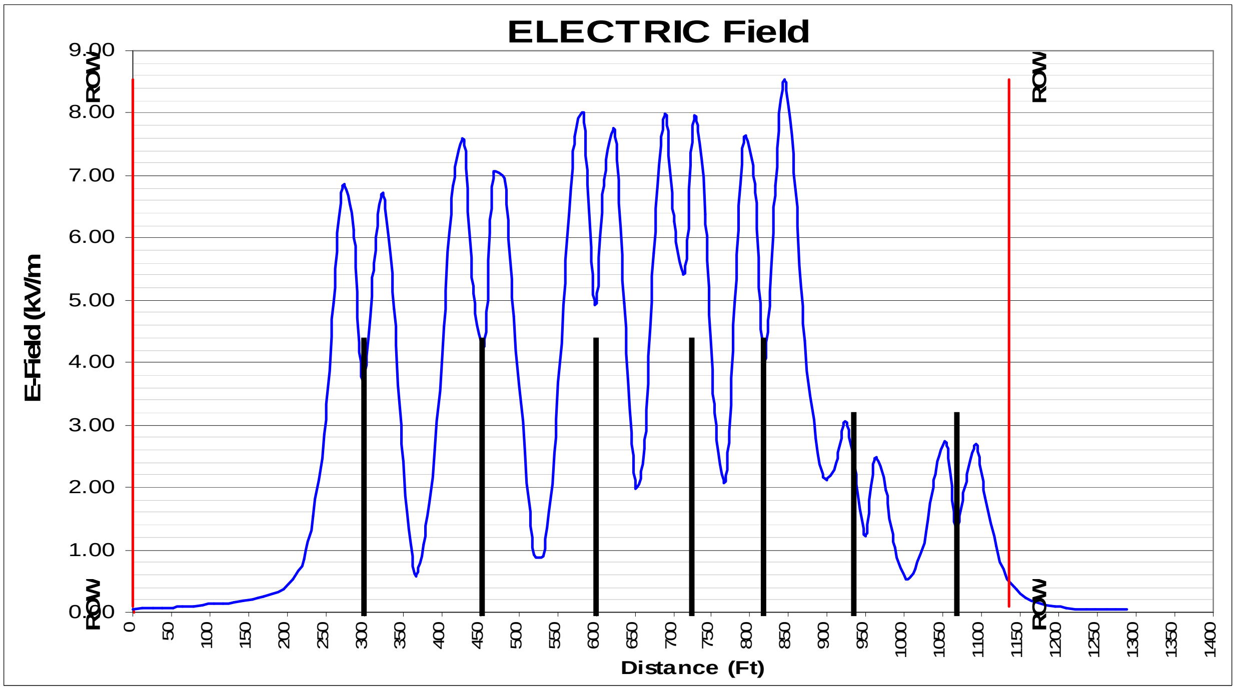
Case #4 ROW EMF cut @ Slatt Sub (Looking SW)

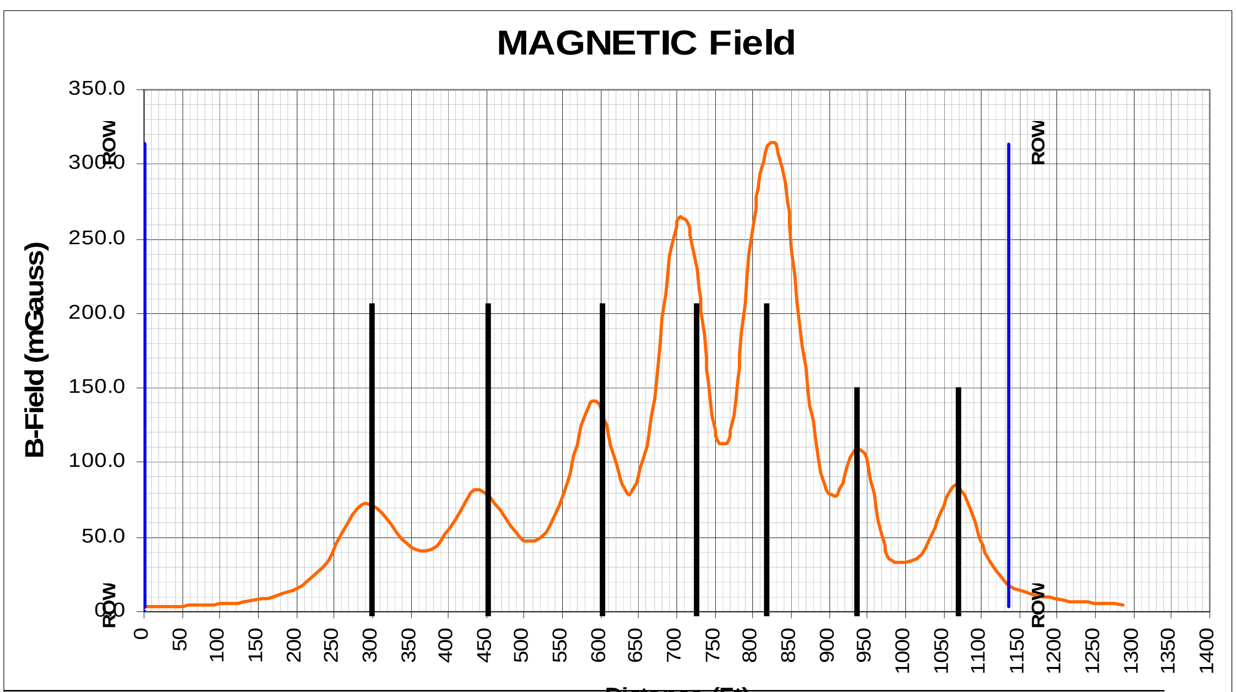




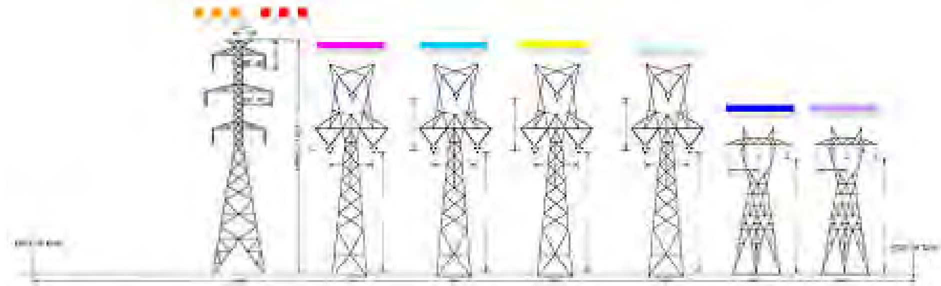
Case #6 ROW EMF cut @ Slatt Sub (Looking SW)

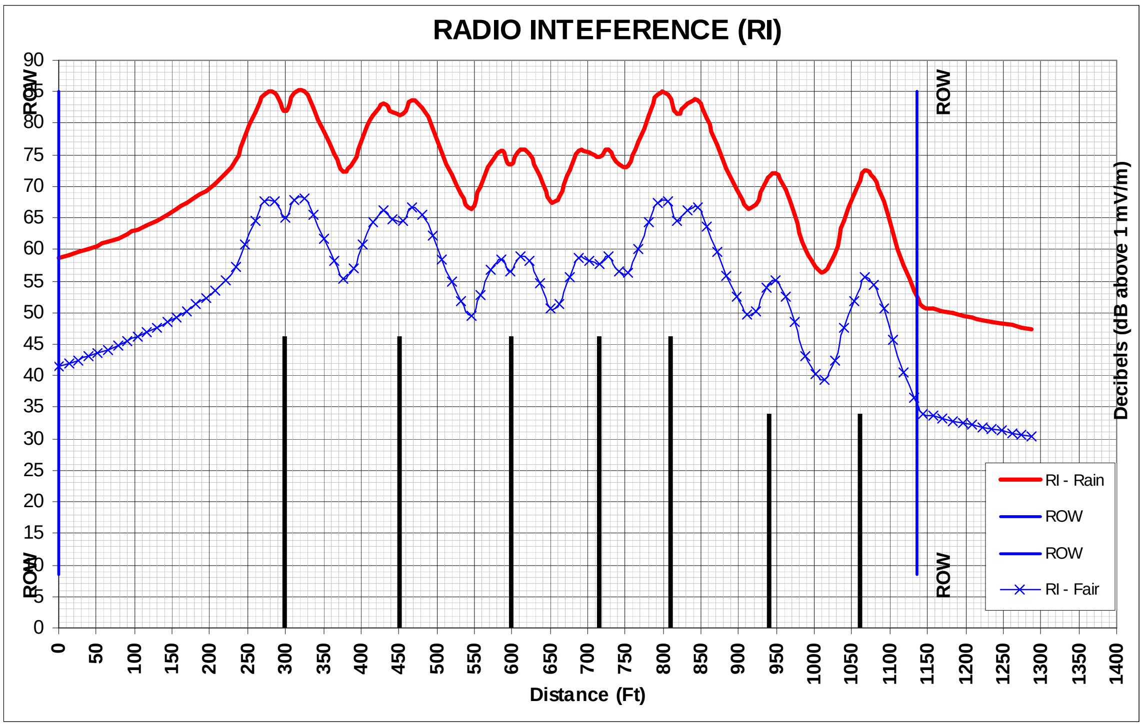






Case #6 ROW EMF cut @ Slatt Sub (Looking SW)





B. BPA Corona & Field Effects Program Tabular Results

Case #1 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)

CORONA AND FIELD EFFECTS PROGRAM Source: Bonneville Power Administration

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Case #1 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)
1-Exist SC 500 kV
1,0,3,5,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',530.00,35.000,2,1.602,18.000,317.55,120.000,0.720,0.000
'BN-SLB','A',550.00,62.500,2,1.602,18.000,317.55,240.000,0.720,0.000
'BN-SLA','A',570.00,35.000,2,1.602,18.000,317.55,0.000,0.720,0.000
'BNSLSW1','A',537.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',562.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
100,0.0,8.0
0,0,0
```

Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBµV/M	RADIO INTERFER (FAIR) L50 DBµV/M	TVI TOTAL RAIN DBµV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	50.3	25.3	47.0	30.0	13.4	0.000000	0.0193	0.5151939
8.0	50.4	25.4	47.1	30.1	13.6	0.000000	0.0199	0.5305509
16.0	50.5	25.5	47.3	30.3	13.9	0.000000	0.0205	0.5466061
24.0	50.6	25.6	47.4	30.4	14.2	0.000000	0.0212	0.5634002
32.0	50.6	25.6	47.5	30.5	14.4	0.000000	0.0218	0.5809817
40.0	50.7	25.7	47.7	30.7	14.7	0.000000	0.0226	0.5993971
48.0	50.8	25.8	47.8	30.8	15.0	0.000000	0.0233	0.6187074
56.0	50.9	25.9	48.0	31.0	15.2	0.000000	0.0241	0.6389629
64.0	50.9	25.9	48.2	31.2	15.5	0.000000	0.0249	0.6602298
72.0	51.0	26.0	48.3	31.3	15.8	0.000000	0.0258	0.6825784
80.0	51.1	26.1	48.5	31.5	16.1	0.000000	0.0267	0.7060806
88.0	51.2	26.2	48.6	31.6	16.4	0.000000	0.0276	0.7308188
96.0	51.3	26.3	48.8	31.8	16.7	0.000000	0.0286	0.7568799
104.0	51.4	26.4	49.0	32.0	16.8	0.000000	0.0297	0.7843613
112.0	51.5	26.5	49.1	32.1	17.0	0.000000	0.0308	0.8133668
120.0	51.5	26.5	49.3	32.3	17.1	0.000000	0.0320	0.8440134
128.0	51.6	26.6	49.5	32.5	17.3	0.000000	0.0333	0.8764235
136.0	51.7	26.7	49.7	32.7	17.5	0.000000	0.0346	0.9107369
144.0	51.8	26.8	49.9	32.9	17.6	0.000000	0.0361	0.9471079
152.0	51.9	26.9	50.1	33.1	17.8	0.000000	0.0376	0.9856999
160.0	52.0	27.0	50.3	33.3	18.0	0.000000	0.0392	1.026701
168.0	52.1	27.1	50.5	33.5	18.2	0.000000	0.0410	1.070314
176.0	52.2	27.2	50.7	33.7	18.3	0.000000	0.0428	1.116766
184.0	52.3	27.3	50.9	33.9	18.5	0.000000	0.0448	1.166308
192.0	52.4	27.4	51.1	34.1	18.7	0.000000	0.0469	1.219219
200.0	52.6	27.6	51.3	34.3	18.9	0.000000	0.0492	1.275814
208.0	52.7	27.7	51.6	34.6	19.1	0.000000	0.0516	1.33644
216.0	52.8	27.8	51.8	34.8	19.3	0.000000	0.0543	1.40149
224.0	52.9	27.9	52.1	35.1	19.5	0.000000	0.0571	1.471403
232.0	53.0	28.0	52.3	35.3	19.7	0.000000	0.0602	1.546679
240.0	53.2	28.2	52.6	35.6	20.2	0.000000	0.0635	1.627874
248.0	53.3	28.3	52.8	35.8	20.7	0.000000	0.0672	1.715625
256.0	53.4	28.4	53.1	36.1	21.2	0.000000	0.0711	1.810658
264.0	53.5	28.5	53.4	36.4	21.7	0.000000	0.0755	1.913795

272.0	53.7	28.7	53.7	36.7	22.2	0.000000	0.0802	2.025986
280.0	53.8	28.8	54.0	37.0	22.6	0.000000	0.0854	2.148312
288.0	54.0	29.0	54.3	37.3	22.9	0.000000	0.0912	2.282031
296.0	54.1	29.1	54.6	37.6	23.2	0.000000	0.0975	2.428597
304.0	54.3	29.3	55.0	38.0	23.5	0.000000	0.1046	2.589696
312.0	54.4	29.4	55.3	38.3	23.8	0.000000	0.1125	2.767304
320.0	54.6	29.6	55.7	38.7	24.1	0.000000	0.1213	2.963743
328.0	54.8	29.8	56.1	39.1	24.4	0.000000	0.1312	3.18175
336.0	55.0	30.0	56.5	39.5	24.8	0.000000	0.1425	3.424574
344.0	55.1	30.1	56.9	39.9	25.1	0.000000	0.1552	3.696094
352.0	55.3	30.3	57.3	40.3	25.5	0.000000	0.1698	4.000965
360.0	55.5	30.5	57.8	40.8	25.9	0.000000	0.1866	4.344815
368.0	55.7	30.7	58.3	41.3	26.3	0.000000	0.2060	4.734492
376.0	56.0	31.0	58.8	41.8	26.7	0.000000	0.2288	5.178393
384.0	56.2	31.2	59.3	42.3	27.2	0.000000	0.2556	5.686881
392.0	56.4	31.4	59.9	42.9	27.7	0.000000	0.2874	6.272874
400.0	56.7	31.7	60.4	43.4	28.2	0.000000	0.3256	6.952605
408.0	56.9	31.9	61.1	44.1	28.7	0.000000	0.3720	7.746658
416.0	57.2	32.2	61.7	44.7	29.3	0.000000	0.4291	8.681419
424.0	57.5	32.5	62.4	45.4	29.9	0.000000	0.5002	9.791037
432.0	57.8	32.8	63.2	46.2	30.5	0.000000	0.5900	11.12021
440.0	58.1	33.1	64.0	47.0	31.2	0.000000	0.7052	12.72813
448.0	58.5	33.5	64.8	47.8	31.9	0.000000	0.8555	14.69396
456.0	58.8	33.8	66.2	49.2	32.7	0.000000	1.0545	17.12477
464.0	59.2	34.2	67.8	50.8	33.6	0.000000	1.3225	20.1664
472.0	59.6	34.6	69.5	52.5	34.6	0.000000	1.6881	24.01821
480.0	60.1	35.1	71.4	54.4	35.6	0.000000	2.1913	28.95048
488.0	60.6	35.6	73.4	56.4	36.8	0.000000	2.8831	35.31862
496.0	61.1	36.1	75.7	58.7	38.1	0.000000	3.8161	43.55204
504.0	61.6	36.6	78.0	61.0	39.5	0.000000	5.0064	54.05577
512.0	62.2	37.2	80.3	63.3	40.8	0.000000	6.3403	66.89861
520.0	62.7	37.7	82.2	65.2	42.0	0.000000	7.4360	81.19395
528.0	63.0	38.0	83.1	66.1	42.6	0.000000	7.6529	94.62801
536.0	63.2	38.2	82.8	65.8	42.4	2.135442	6.5628	104.4318
544.0	63.3	38.3	81.3	64.3	41.5	3.630351	4.6502	109.4937
552.0	63.3	38.3	80.3	63.3	40.8	3.025844	3.9370	110.4295
560.0	63.2	38.2	82.2	65.2	42.0	3.186320	5.6298	107.5353
568.0	63.1	38.1	83.1	66.1	42.6	3.822716	7.2687	100.1101
576.0	62.9	37.9	82.8	65.8	42.4	5.784084	7.6950	88.20687
584.0	62.4	37.4	81.3	64.3	41.5	6.936178	6.9546	73.97681
592.0	61.9	36.9	79.2	62.2	40.1	6.002386	5.6715	60.20897
600.0	61.4	36.4	76.8	59.8	38.8	5.185127	4.3816	48.50208
608.0	60.8	35.8	74.5	57.5	37.4	4.559390	3.3168	39.17406
616.0	60.3	35.3	72.4	55.4	36.2	4.074262	2.5101	31.92945
624.0	59.9	34.9	70.4	53.4	35.1	3.688325	1.9195	26.32917
632.0	59.4	34.4	68.6	51.6	34.1	3.373881	1.4909	21.97602
640.0	59.0	34.0	67.0	50.0	33.2	3.112477	1.1784	18.55822
648.0	58.6	33.6	65.5	48.5	32.3	2.891489	0.9478	15.84318
656.0	58.3	33.3	64.4	47.4	31.6	2.702021	0.7752	13.66037
664.0	58.0	33.0	63.6	46.6	30.8	2.537629	0.6439	11.88491
672.0	57.6	32.6	62.8	45.8	30.2	2.393531	0.5424	10.42486
680.0	57.3	32.3	62.1	45.1	29.5	2.266102	0.4626	9.211851
688.0	57.1	32.1	61.4	44.4	29.0	2.152540	0.3990	8.194513
696.0	56.8	31.8	60.8	43.8	28.4	2.050646	0.3477	7.333837
704.0	56.5	31.5	60.1	43.1	27.9	1.958668	0.3056	6.599838
712.0	56.3	31.3	59.6	42.6	27.4	1.875192	0.2708	5.969257
720.0	56.1	31.1	59.0	42.0	27.0	1.799063	0.2416	5.423811
728.0	55.8	30.8	58.5	41.5	26.5	1.729331	0.2170	4.94906
736.0	55.6	30.6	58.0	41.0	26.1	1.665202	0.1960	4.533432
744.0	55.4	30.4	57.5	40.5	25.7	1.606012	0.1779	4.167611
752.0	55.2	30.2	57.1	40.1	25.3	1.551198	0.1623	3.844024

760.0	55.1	30.1	56.7	39.7	24.9	1.500281	0.1486	3.556466
768.0	54.9	29.9	56.3	39.3	24.6	1.452850	0.1367	3.299823
776.0	54.7	29.7	55.9	38.9	24.3	1.408550	0.1261	3.069852
784.0	54.5	29.5	55.5	38.5	23.9	1.367075	0.1168	2.863
792.0	54.4	29.4	55.1	38.1	23.6	1.328156	0.1084	2.676292

Case #2 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)

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Case #2 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)
1-Exist SC 500 kV
1,0,3,5,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',530.00,35.000,2,1.602,18.000,317.55,120.000,1.267,0.000
'BN-SLB','A',550.00,62.500,2,1.602,18.000,317.55,240.000,1.267,0.000
'BN-SLA','A',570.00,35.000,2,1.602,18.000,317.55,0.000,1.267,0.000
'BNSLSW1','A',537.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',562.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
100,0.0,8.0
0,0,0
```

Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	50.3	25.3	47.0	30.0	13.4	0.000000	0.0193	0.9543136
8.0	50.4	25.4	47.1	30.1	13.6	0.000000	0.0199	0.9827599
16.0	50.5	25.5	47.3	30.3	13.9	0.000000	0.0205	1.012499
24.0	50.6	25.6	47.4	30.4	14.2	0.000000	0.0212	1.043609
32.0	50.6	25.6	47.5	30.5	14.4	0.000000	0.0218	1.076174
40.0	50.7	25.7	47.7	30.7	14.7	0.000000	0.0226	1.110288
48.0	50.8	25.8	47.8	30.8	15.0	0.000000	0.0233	1.146055
56.0	50.9	25.9	48.0	31.0	15.2	0.000000	0.0241	1.183575
64.0	50.9	25.9	48.2	31.2	15.5	0.000000	0.0249	1.222969
72.0	51.0	26.0	48.3	31.3	15.8	0.000000	0.0258	1.264367
80.0	51.1	26.1	48.5	31.5	16.1	0.000000	0.0267	1.3079
88.0	51.2	26.2	48.6	31.6	16.4	0.000000	0.0276	1.353724
96.0	51.3	26.3	48.8	31.8	16.7	0.000000	0.0286	1.401999
104.0	51.4	26.4	49.0	32.0	16.8	0.000000	0.0297	1.452902
112.0	51.5	26.5	49.1	32.1	17.0	0.000000	0.0308	1.506632
120.0	51.5	26.5	49.3	32.3	17.1	0.000000	0.0320	1.5634
128.0	51.6	26.6	49.5	32.5	17.3	0.000000	0.0333	1.623435
136.0	51.7	26.7	49.7	32.7	17.5	0.000000	0.0346	1.686994
144.0	51.8	26.8	49.9	32.9	17.6	0.000000	0.0361	1.754365
152.0	51.9	26.9	50.1	33.1	17.8	0.000000	0.0376	1.825851
160.0	52.0	27.0	50.3	33.3	18.0	0.000000	0.0392	1.901799
168.0	52.1	27.1	50.5	33.5	18.2	0.000000	0.0410	1.982584
176.0	52.2	27.2	50.7	33.7	18.3	0.000000	0.0428	2.068628
184.0	52.3	27.3	50.9	33.9	18.5	0.000000	0.0448	2.160396
192.0	52.4	27.4	51.1	34.1	18.7	0.000000	0.0469	2.258406
200.0	52.6	27.6	51.3	34.3	18.9	0.000000	0.0492	2.363241
208.0	52.7	27.7	51.6	34.6	19.1	0.000000	0.0516	2.47554
216.0	52.8	27.8	51.8	34.8	19.3	0.000000	0.0543	2.596036
224.0	52.9	27.9	52.1	35.1	19.5	0.000000	0.0571	2.725539
232.0	53.0	28.0	52.3	35.3	19.7	0.000000	0.0602	2.864973
240.0	53.2	28.2	52.6	35.6	20.2	0.000000	0.0635	3.015373
248.0	53.3	28.3	52.8	35.8	20.7	0.000000	0.0672	3.17792
256.0	53.4	28.4	53.1	36.1	21.2	0.000000	0.0711	3.353953
264.0	53.5	28.5	53.4	36.4	21.7	0.000000	0.0755	3.544999
272.0	53.7	28.7	53.7	36.7	22.2	0.000000	0.0802	3.752811
280.0	53.8	28.8	54.0	37.0	22.6	0.000000	0.0854	3.9794

288.0	54.0	29.0	54.3	37.3	22.9	0.000000	0.0912	4.227096
296.0	54.1	29.1	54.6	37.6	23.2	0.000000	0.0975	4.498586
304.0	54.3	29.3	55.0	38.0	23.5	0.000000	0.1046	4.796994
312.0	54.4	29.4	55.3	38.3	23.8	0.000000	0.1125	5.125986
320.0	54.6	29.6	55.7	38.7	24.1	0.000000	0.1213	5.489856
328.0	54.8	29.8	56.1	39.1	24.4	0.000000	0.1312	5.893679
336.0	55.0	30.0	56.5	39.5	24.8	0.000000	0.1425	6.343472
344.0	55.1	30.1	56.9	39.9	25.1	0.000000	0.1552	6.846419
352.0	55.3	30.3	57.3	40.3	25.5	0.000000	0.1698	7.411144
360.0	55.5	30.5	57.8	40.8	25.9	0.000000	0.1866	8.048071
368.0	55.7	30.7	58.3	41.3	26.3	0.000000	0.2060	8.769886
376.0	56.0	31.0	58.8	41.8	26.7	0.000000	0.2288	9.592143
384.0	56.2	31.2	59.3	42.3	27.2	0.000000	0.2556	10.53403
392.0	56.4	31.4	59.9	42.9	27.7	0.000000	0.2874	11.61949
400.0	56.7	31.7	60.4	43.4	28.2	0.000000	0.3256	12.87858
408.0	56.9	31.9	61.1	44.1	28.7	0.000000	0.3720	14.34944
416.0	57.2	32.2	61.7	44.7	29.3	0.000000	0.4291	16.08093
424.0	57.5	32.5	62.4	45.4	29.9	0.000000	0.5002	18.13631
432.0	57.8	32.8	63.2	46.2	30.5	0.000000	0.5900	20.59841
440.0	58.1	33.1	64.0	47.0	31.2	0.000000	0.7052	23.57681
448.0	58.5	33.5	64.8	47.8	31.9	0.000000	0.8555	27.2182
456.0	58.8	33.8	66.2	49.2	32.7	0.000000	1.0545	31.72088
464.0	59.2	34.2	67.8	50.8	33.6	0.000000	1.3225	37.35501
472.0	59.6	34.6	69.5	52.5	34.6	0.000000	1.6881	44.48988
480.0	60.1	35.1	71.4	54.4	35.6	0.000000	2.1913	53.62611
488.0	60.6	35.6	73.4	56.4	36.8	0.000000	2.8831	65.42207
496.0	61.1	36.1	75.7	58.7	38.1	0.000000	3.8161	80.67314
504.0	61.6	36.6	78.0	61.0	39.5	0.000000	5.0064	100.1296
512.0	62.2	37.2	80.3	63.3	40.8	0.000000	6.3403	123.9189
520.0	62.7	37.7	82.2	65.2	42.0	0.000000	7.4360	150.3987
528.0	63.0	38.0	83.1	66.1	42.6	0.000000	7.6529	175.2832
536.0	63.2	38.2	82.8	65.8	42.4	2.135442	6.5628	193.4431
544.0	63.3	38.3	81.3	64.3	41.5	3.630351	4.6502	202.8195
552.0	63.3	38.3	80.3	63.3	40.8	3.025844	3.9370	204.5529
560.0	63.2	38.2	82.2	65.2	42.0	3.186320	5.6298	199.1919
568.0	63.1	38.1	83.1	66.1	42.6	3.822716	7.2687	185.4379
576.0	62.9	37.9	82.8	65.8	42.4	5.784084	7.6950	163.389
584.0	62.4	37.4	81.3	64.3	41.5	6.936178	6.9546	137.0301
592.0	61.9	36.9	79.2	62.2	40.1	6.002386	5.6715	111.5274
600.0	61.4	36.4	76.8	59.8	38.8	5.185127	4.3816	89.8423
608.0	60.8	35.8	74.5	57.5	37.4	4.559390	3.3168	72.56363
616.0	60.3	35.3	72.4	55.4	36.2	4.074262	2.5101	59.14417
624.0	59.9	34.9	70.4	53.4	35.1	3.688325	1.9195	48.77055
632.0	59.4	34.4	68.6	51.6	34.1	3.373881	1.4909	40.70704
640.0	59.0	34.0	67.0	50.0	33.2	3.112477	1.1784	34.37612
648.0	58.6	33.6	65.5	48.5	32.3	2.891489	0.9478	29.34694
656.0	58.3	33.3	64.4	47.4	31.6	2.702021	0.7752	25.30363
664.0	58.0	33.0	63.6	46.6	30.8	2.537629	0.6439	22.01489
672.0	57.6	32.6	62.8	45.8	30.2	2.393531	0.5424	19.31038
680.0	57.3	32.3	62.1	45.1	29.5	2.266102	0.4626	17.06347
688.0	57.1	32.1	61.4	44.4	29.0	2.152540	0.3990	15.17901
696.0	56.8	31.8	60.8	43.8	28.4	2.050646	0.3477	13.58475
704.0	56.5	31.5	60.1	43.1	27.9	1.958668	0.3056	12.22514
712.0	56.3	31.3	59.6	42.6	27.4	1.875192	0.2708	11.05709
720.0	56.1	31.1	59.0	42.0	27.0	1.799063	0.2416	10.04674
728.0	55.8	30.8	58.5	41.5	26.5	1.729331	0.2170	9.167339
736.0	55.6	30.6	58.0	41.0	26.1	1.665202	0.1960	8.397455
744.0	55.4	30.4	57.5	40.5	25.7	1.606012	0.1779	7.719831
752.0	55.2	30.2	57.1	40.1	25.3	1.551198	0.1623	7.120436
760.0	55.1	30.1	56.7	39.7	24.9	1.500281	0.1486	6.587779
768.0	54.9	29.9	56.3	39.3	24.6	1.452850	0.1367	6.112393

776.0	54.7	29.7	55.9	38.9	24.3	1.408550	0.1261	5.686408
784.0	54.5	29.5	55.5	38.5	23.9	1.367075	0.1168	5.303248
792.0	54.4	29.4	55.1	38.1	23.6	1.328156	0.1084	4.957401

Case #3 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)

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Case #3 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)
1-New SC 500 kV_1-Exist SC 500 kV
1,0,6,10,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',530.00,35.000,2,1.602,18.000,317.55,120.000,0.634,0.000
'BN-SLB','A',550.00,62.500,2,1.602,18.000,317.55,240.000,0.634,0.000
'BN-SLA','A',570.00,35.000,2,1.602,18.000,317.55,0.000,0.634,0.000
'CT-SL1C','A',330.00,35.000,2,1.602,18.000,317.55,120.000,0.634,0.000
'CT-SL1B','A',350.00,62.500,2,1.602,18.000,317.55,240.000,0.634,0.000
'CT-SL1A','A',370.00,35.000,2,1.602,18.000,317.55,0.000,0.634,0.000
'BNSLSW1','A',537.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',562.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSLSW1','A',337.08,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSLSW2','A',362.92,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,8.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	54.6	29.6	51.2	34.2	18.8	0.000000	0.0632	1.658951
8.0	54.7	29.7	51.5	34.5	19.0	0.000000	0.0660	1.729253
16.0	54.8	29.8	51.7	34.7	19.2	0.000000	0.0690	1.804286
24.0	54.9	29.9	51.9	34.9	19.4	0.000000	0.0722	1.884492
32.0	55.0	30.0	52.2	35.2	19.7	0.000000	0.0757	1.970372
40.0	55.1	30.1	52.5	35.5	20.2	0.000000	0.0794	2.062489
48.0	55.2	30.2	52.7	35.7	20.7	0.000000	0.0835	2.161479
56.0	55.4	30.4	53.0	36.0	21.2	0.000000	0.0878	2.268059
64.0	55.5	30.5	53.3	36.3	21.7	0.000000	0.0926	2.383043
72.0	55.6	30.6	53.6	36.6	22.2	0.000000	0.0978	2.507375
80.0	55.7	30.7	53.9	36.9	22.6	0.000000	0.1034	2.64211
88.0	55.8	30.8	54.2	37.2	22.8	0.000000	0.1096	2.788479
96.0	56.0	31.0	54.5	37.5	23.1	0.000000	0.1164	2.947896
104.0	56.1	31.1	54.9	37.9	23.4	0.000000	0.1239	3.121999
112.0	56.2	31.2	55.2	38.2	23.7	0.000000	0.1323	3.312693
120.0	56.4	31.4	55.6	38.6	24.1	0.000000	0.1416	3.522209
128.0	56.5	31.5	56.0	39.0	24.4	0.000000	0.1519	3.753171
136.0	56.7	31.7	56.4	39.4	24.7	0.000000	0.1636	4.008675
144.0	56.8	31.8	56.8	39.8	25.1	0.000000	0.1768	4.292409
152.0	57.0	32.0	57.2	40.2	25.5	0.000000	0.1918	4.608774
160.0	57.2	32.2	57.7	40.7	25.9	0.000000	0.2090	4.963073
168.0	57.3	32.3	58.2	41.2	26.3	0.000000	0.2288	5.361731
176.0	57.5	32.5	58.7	41.7	26.7	0.000000	0.2518	5.812593
184.0	57.7	32.7	59.2	42.2	27.2	0.000000	0.2788	6.325304
192.0	57.9	32.9	59.7	42.7	27.6	0.000000	0.3108	6.911855
200.0	58.1	33.1	60.3	43.3	28.1	0.000000	0.3491	7.587224
208.0	58.3	33.3	61.0	44.0	28.7	0.000000	0.3954	8.370355
216.0	58.6	33.6	61.6	44.6	29.2	0.000000	0.4523	9.285418
224.0	58.8	33.8	62.3	45.3	29.8	0.000000	0.5231	10.36358
232.0	59.1	34.1	63.1	46.1	30.5	0.000000	0.6124	11.64547
240.0	59.3	34.3	63.9	46.9	31.2	0.000000	0.7269	13.18465
248.0	59.6	34.6	64.8	47.8	31.9	0.000000	0.8763	15.05248

256.0	59.9	34.9	66.2	49.2	32.7	0.000000	1.0743	17.34496
264.0	60.3	35.3	67.8	50.8	33.6	0.000000	1.3410	20.19228
272.0	60.6	35.6	69.5	52.5	34.6	0.000000	1.7052	23.77121
280.0	61.0	36.0	71.3	54.3	35.6	0.000000	2.2069	28.31978
288.0	61.5	36.5	73.4	56.4	36.8	0.000000	2.8973	34.1477
296.0	61.9	36.9	75.6	58.6	38.1	0.000000	3.8290	41.62259
304.0	62.4	37.4	78.0	61.0	39.4	0.000000	5.0182	51.07577
312.0	62.9	37.9	80.3	63.3	40.8	0.000000	6.3515	62.5164
320.0	63.3	38.3	82.2	65.2	42.0	0.000000	7.4472	75.08181
328.0	63.6	38.6	83.1	66.1	42.6	0.000000	7.6646	86.65366
336.0	63.8	38.8	82.8	65.8	42.4	2.127247	6.5742	94.79363
344.0	63.9	38.9	81.3	64.3	41.4	3.616416	4.6533	98.63637
352.0	64.0	39.0	80.5	63.5	41.0	3.014228	3.9025	98.86523
360.0	64.0	39.0	82.4	65.4	42.2	3.164784	5.5664	95.83304
368.0	63.9	38.9	83.3	66.3	42.8	3.785030	7.1815	88.97668
376.0	63.7	38.7	83.0	66.0	42.6	5.814605	7.5777	78.38041
384.0	63.4	38.4	81.5	64.5	41.6	7.018032	6.7995	65.94482
392.0	63.1	38.1	79.4	62.4	40.3	6.068122	5.4717	54.09847
400.0	62.7	37.7	77.0	60.0	39.0	5.236687	4.1308	44.21655
408.0	62.4	37.4	74.7	57.7	37.6	4.601062	3.0081	36.5638
416.0	62.1	37.1	72.6	55.6	36.4	4.108970	2.1345	30.88709
424.0	61.9	36.9	70.6	53.6	35.3	3.717951	1.4655	26.82624
432.0	61.8	36.8	68.8	51.8	34.3	3.399677	0.9437	24.07523
440.0	61.7	36.7	67.2	50.2	33.4	3.135298	0.5225	22.41947
448.0	61.6	36.6	65.7	48.7	32.5	2.911941	0.1975	21.73151
456.0	61.6	36.6	66.4	49.4	32.9	2.720545	0.3435	21.95942
464.0	61.7	36.7	68.0	51.0	33.8	2.554559	0.7226	23.12031
472.0	61.8	36.8	69.7	52.7	34.8	2.409121	1.1894	25.30259
480.0	62.0	37.0	71.6	54.6	35.8	2.280550	1.7778	28.67585
488.0	62.2	37.2	73.6	56.6	37.0	2.166005	2.5416	33.50122
496.0	62.5	37.5	75.9	58.9	38.3	2.063256	3.5365	40.12152
504.0	62.9	37.9	78.2	61.2	39.7	1.970527	4.7809	48.8763
512.0	63.2	38.2	80.5	63.5	41.0	1.886387	6.1624	59.83008
520.0	63.6	38.6	82.4	65.4	42.2	1.809667	7.2994	72.22752
528.0	63.8	38.8	83.3	66.3	42.8	1.739405	7.5502	84.06521
536.0	64.0	39.0	83.0	66.0	42.6	3.880674	6.4863	92.91769
544.0	64.0	39.0	81.5	64.5	41.7	5.365266	4.5965	97.78159
552.0	63.9	38.9	80.3	63.3	40.8	4.685613	3.9227	99.15328
560.0	63.9	38.9	82.2	65.2	42.0	4.762739	5.6372	97.2248
568.0	63.8	38.8	83.1	66.1	42.6	5.317275	7.2791	91.2589
576.0	63.5	38.5	82.8	65.8	42.4	7.215456	7.7051	81.16055
584.0	63.1	38.1	81.3	64.3	41.4	8.316499	6.9646	68.76305
592.0	62.6	37.6	79.2	62.2	40.1	7.343280	5.6818	56.57337
600.0	62.2	37.2	76.8	59.8	38.7	6.489542	4.3930	46.08842
608.0	61.7	36.7	74.5	57.5	37.4	5.829356	3.3297	37.65559
616.0	61.2	36.2	72.4	55.4	36.2	5.311593	2.5246	31.05165
624.0	60.8	35.8	70.4	53.4	35.1	4.894706	1.9358	25.90664
632.0	60.5	35.5	68.6	51.6	34.1	4.550886	1.5089	21.87699
640.0	60.1	35.1	67.0	50.0	33.2	4.261573	1.1979	18.68945
648.0	59.8	34.8	65.5	48.5	32.3	4.014041	0.9687	16.13841
656.0	59.5	34.5	64.3	47.3	31.5	3.799303	0.7973	14.07214
664.0	59.2	34.2	63.4	46.4	30.8	3.610826	0.6669	12.37891
672.0	58.9	33.9	62.7	45.7	30.2	3.443749	0.5660	10.97604
680.0	58.7	33.7	62.0	45.0	29.5	3.294372	0.4868	9.801804
688.0	58.4	33.4	61.3	44.3	28.9	3.159825	0.4235	8.809609
696.0	58.2	33.2	60.6	43.6	28.4	3.037847	0.3722	7.963926
704.0	58.0	33.0	60.0	43.0	27.9	2.926629	0.3301	7.237334
712.0	57.8	32.8	59.4	42.4	27.4	2.824704	0.2952	6.608479
720.0	57.6	32.6	58.9	41.9	26.9	2.730869	0.2658	6.060511
728.0	57.4	32.4	58.4	41.4	26.5	2.644128	0.2409	5.580061
736.0	57.2	32.2	57.9	40.9	26.1	2.563647	0.2195	5.156386

744.0	57.1	32.1	57.4	40.4	25.7	2.488723	0.2010	4.780794
752.0	56.9	31.9	57.0	40.0	25.3	2.418759	0.1849	4.446188
760.0	56.8	31.8	56.5	39.5	24.9	2.353243	0.1709	4.146743
768.0	56.6	31.6	56.1	39.1	24.6	2.291734	0.1584	3.877623
776.0	56.4	31.4	55.7	38.7	24.2	2.233849	0.1474	3.634811
784.0	56.3	31.3	55.4	38.4	23.9	2.179255	0.1375	3.414928
792.0	56.2	31.2	55.0	38.0	23.6	2.127660	0.1287	3.215121

Case #4 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)

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Case #4 ROW EMF Cut Cut @ NSY Near Boardman Plant
(Looking W)
1-New SC 500 kV_1-Exist SC 500 kV
1,0,6,10,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',530.00,35.000,2,1.602,18.000,317.55,120.000,0.907,0.000
'BN-SLB','A',550.00,62.500,2,1.602,18.000,317.55,240.000,0.907,0.000
'BN-SLA','A',570.00,35.000,2,1.602,18.000,317.55,0.000,0.907,0.000
'CT-SL1C','A',330.00,35.000,2,1.602,18.000,317.55,120.000,0.907,0.000
'CT-SL1B','A',350.00,62.500,2,1.602,18.000,317.55,240.000,0.907,0.000
'CT-SL1A','A',370.00,35.000,2,1.602,18.000,317.55,0.000,0.907,0.000
'BNSLSW1','A',537.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',562.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSLSW1','A',337.08,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSLSW2','A',362.92,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,8.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	54.6	29.6	51.2	34.2	18.8	0.000000	0.0632	2.373294
8.0	54.7	29.7	51.5	34.5	19.0	0.000000	0.0660	2.473869
16.0	54.8	29.8	51.7	34.7	19.2	0.000000	0.0690	2.58121
24.0	54.9	29.9	51.9	34.9	19.4	0.000000	0.0722	2.695951
32.0	55.0	30.0	52.2	35.2	19.7	0.000000	0.0757	2.818814
40.0	55.1	30.1	52.5	35.5	20.2	0.000000	0.0794	2.950595
48.0	55.2	30.2	52.7	35.7	20.7	0.000000	0.0835	3.092211
56.0	55.4	30.4	53.0	36.0	21.2	0.000000	0.0878	3.244684
64.0	55.5	30.5	53.3	36.3	21.7	0.000000	0.0926	3.409181
72.0	55.6	30.6	53.6	36.6	22.2	0.000000	0.0978	3.587049
80.0	55.7	30.7	53.9	36.9	22.6	0.000000	0.1034	3.7798
88.0	55.8	30.8	54.2	37.2	22.8	0.000000	0.1096	3.989195
96.0	56.0	31.0	54.5	37.5	23.1	0.000000	0.1164	4.217257
104.0	56.1	31.1	54.9	37.9	23.4	0.000000	0.1239	4.466331
112.0	56.2	31.2	55.2	38.2	23.7	0.000000	0.1323	4.739136
120.0	56.4	31.4	55.6	38.6	24.1	0.000000	0.1416	5.038871
128.0	56.5	31.5	56.0	39.0	24.4	0.000000	0.1519	5.369283
136.0	56.7	31.7	56.4	39.4	24.7	0.000000	0.1636	5.734806
144.0	56.8	31.8	56.8	39.8	25.1	0.000000	0.1768	6.140718
152.0	57.0	32.0	57.2	40.2	25.5	0.000000	0.1918	6.59331
160.0	57.2	32.2	57.7	40.7	25.9	0.000000	0.2090	7.10017
168.0	57.3	32.3	58.2	41.2	26.3	0.000000	0.2288	7.670487
176.0	57.5	32.5	58.7	41.7	26.7	0.000000	0.2518	8.315493
184.0	57.7	32.7	59.2	42.2	27.2	0.000000	0.2788	9.048975
192.0	57.9	32.9	59.7	42.7	27.6	0.000000	0.3108	9.888092
200.0	58.1	33.1	60.3	43.3	28.1	0.000000	0.3491	10.85428
208.0	58.3	33.3	61.0	44.0	28.7	0.000000	0.3954	11.97463
216.0	58.6	33.6	61.6	44.6	29.2	0.000000	0.4523	13.28371
224.0	58.8	33.8	62.3	45.3	29.8	0.000000	0.5231	14.82613
232.0	59.1	34.1	63.1	46.1	30.5	0.000000	0.6124	16.66001

240.0	59.3	34.3	63.9	46.9	31.2	0.000000	0.7269	18.86196
248.0	59.6	34.6	64.8	47.8	31.9	0.000000	0.8763	21.53406
256.0	59.9	34.9	66.2	49.2	32.7	0.000000	1.0743	24.81369
264.0	60.3	35.3	67.8	50.8	33.6	0.000000	1.3410	28.88706
272.0	60.6	35.6	69.5	52.5	34.6	0.000000	1.7052	34.00708
280.0	61.0	36.0	71.3	54.3	35.6	0.000000	2.2069	40.51426
288.0	61.5	36.5	73.4	56.4	36.8	0.000000	2.8973	48.85169
296.0	61.9	36.9	75.6	58.6	38.1	0.000000	3.8290	59.54526
304.0	62.4	37.4	78.0	61.0	39.4	0.000000	5.0182	73.06895
312.0	62.9	37.9	80.3	63.3	40.8	0.000000	6.3515	89.43591
320.0	63.3	38.3	82.2	65.2	42.0	0.000000	7.4472	107.412
328.0	63.6	38.6	83.1	66.1	42.6	0.000000	7.6646	123.9667
336.0	63.8	38.8	82.8	65.8	42.4	2.127247	6.5742	135.6117
344.0	63.9	38.9	81.3	64.3	41.4	3.616416	4.6533	141.1091
352.0	64.0	39.0	80.5	63.5	41.0	3.014228	3.9025	141.4365
360.0	64.0	39.0	82.4	65.4	42.2	3.164784	5.5664	137.0987
368.0	63.9	38.9	83.3	66.3	42.8	3.785030	7.1815	127.29
376.0	63.7	38.7	83.0	66.0	42.6	5.814605	7.5777	112.131
384.0	63.4	38.4	81.5	64.5	41.6	7.018032	6.7995	94.34062
392.0	63.1	38.1	79.4	62.4	40.3	6.068122	5.4717	77.39323
400.0	62.7	37.7	77.0	60.0	39.0	5.236687	4.1308	63.25615
408.0	62.4	37.4	74.7	57.7	37.6	4.601062	3.0081	52.30815
416.0	62.1	37.1	72.6	55.6	36.4	4.108970	2.1345	44.18705
424.0	61.9	36.9	70.6	53.6	35.3	3.717951	1.4655	38.37759
432.0	61.8	36.8	68.8	51.8	34.3	3.399677	0.9437	34.44201
440.0	61.7	36.7	67.2	50.2	33.4	3.135298	0.5225	32.07328
448.0	61.6	36.6	65.7	48.7	32.5	2.911941	0.1975	31.08909
456.0	61.6	36.6	66.4	49.4	32.9	2.720545	0.3435	31.41513
464.0	61.7	36.7	68.0	51.0	33.8	2.554559	0.7226	33.0759
472.0	61.8	36.8	69.7	52.7	34.8	2.409121	1.1894	36.19787
480.0	62.0	37.0	71.6	54.6	35.8	2.280550	1.7778	41.02365
488.0	62.2	37.2	73.6	56.6	37.0	2.166005	2.5416	47.92682
496.0	62.5	37.5	75.9	58.9	38.3	2.063256	3.5365	57.39782
504.0	62.9	37.9	78.2	61.2	39.7	1.970527	4.7809	69.92241
512.0	63.2	38.2	80.5	63.5	41.0	1.886387	6.1624	85.59287
520.0	63.6	38.6	82.4	65.4	42.2	1.809667	7.2994	103.3287
528.0	63.8	38.8	83.3	66.3	42.8	1.739405	7.5502	120.2636
536.0	64.0	39.0	83.0	66.0	42.6	3.880674	6.4863	132.928
544.0	64.0	39.0	81.5	64.5	41.7	5.365266	4.5965	139.8863
552.0	63.9	38.9	80.3	63.3	40.8	4.685613	3.9227	141.8486
560.0	63.9	38.9	82.2	65.2	42.0	4.762739	5.6372	139.0897
568.0	63.8	38.8	83.1	66.1	42.6	5.317275	7.2791	130.5549
576.0	63.5	38.5	82.8	65.8	42.4	7.215456	7.7051	116.1082
584.0	63.1	38.1	81.3	64.3	41.4	8.316499	6.9646	98.37238
592.0	62.6	37.6	79.2	62.2	40.1	7.343280	5.6818	80.93383
600.0	62.2	37.2	76.8	59.8	38.7	6.489542	4.3930	65.93407
608.0	61.7	36.7	74.5	57.5	37.4	5.829356	3.3297	53.87007
616.0	61.2	36.2	72.4	55.4	36.2	5.311593	2.5246	44.42247
624.0	60.8	35.8	70.4	53.4	35.1	4.894706	1.9358	37.06202
632.0	60.5	35.5	68.6	51.6	34.1	4.550886	1.5089	31.29721
640.0	60.1	35.1	67.0	50.0	33.2	4.261573	1.1979	26.73711
648.0	59.8	34.8	65.5	48.5	32.3	4.014041	0.9687	23.0876
656.0	59.5	34.5	64.3	47.3	31.5	3.799303	0.7973	20.13158
664.0	59.2	34.2	63.4	46.4	30.8	3.610826	0.6669	17.70925
672.0	58.9	33.9	62.7	45.7	30.2	3.443749	0.5660	15.70231
680.0	58.7	33.7	62.0	45.0	29.5	3.294372	0.4868	14.02246
688.0	58.4	33.4	61.3	44.3	28.9	3.159825	0.4235	12.60302
696.0	58.2	33.2	60.6	43.6	28.4	3.037847	0.3722	11.39319
704.0	58.0	33.0	60.0	43.0	27.9	2.926629	0.3301	10.35372
712.0	57.8	32.8	59.4	42.4	27.4	2.824704	0.2952	9.454085
720.0	57.6	32.6	58.9	41.9	26.9	2.730869	0.2658	8.670162

728.0	57.4	32.4	58.4	41.4	26.5	2.644128	0.2409	7.982833
736.0	57.2	32.2	57.9	40.9	26.1	2.563647	0.2195	7.376723
744.0	57.1	32.1	57.4	40.4	25.7	2.488723	0.2010	6.8394
752.0	56.9	31.9	57.0	40.0	25.3	2.418759	0.1849	6.360713
760.0	56.8	31.8	56.5	39.5	24.9	2.353243	0.1709	5.932326
768.0	56.6	31.6	56.1	39.1	24.6	2.291734	0.1584	5.547326
776.0	56.4	31.4	55.7	38.7	24.2	2.233849	0.1474	5.19996
784.0	56.3	31.3	55.4	38.4	23.9	2.179255	0.1375	4.885392
792.0	56.2	31.2	55.0	38.0	23.6	2.127660	0.1287	4.599551

Case #6 ROW EMF Cut @ NSY Near Boardman Plant (Looking W)

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Case #6 ROW EMF Cut @ NSY Near Boardman Plant
(Looking W)_L2ABC-L1CBA
1-New DC 500 kV_1-Exist SC 230 kV
1,0,9,13,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',530.00,35.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'BN-SLB','A',550.00,62.500,2,1.602,18.000,317.55,240.000,0.605,0.000
'BN-SLA','A',570.00,35.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'CT-SL1C','A',370.00,95.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'CT-SL1B','A',375.00,65.000,2,1.602,18.000,317.55,240.000,0.605,0.000
'CT-SL1A','A',370.00,35.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'CT-SL2A','A',330.00,95.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'CT-SL2B','A',325.00,65.000,2,1.602,18.000,317.55,240.000,0.605,0.000
'CT-SL2C','A',330.00,35.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'BNSLSW1','A',537.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',562.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSLDSW1','A',340.00,137.500,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSLDSW2','A',360.00,137.500,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,8.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	57.8	32.8	56.9	39.9	20.9	0.000000	0.0326	0.6927855
8.0	57.9	32.9	57.1	40.1	21.1	0.000000	0.0346	0.7271724
16.0	58.0	33.0	57.3	40.3	21.3	0.000000	0.0367	0.7644325
24.0	58.1	33.1	57.6	40.6	21.5	0.000000	0.0391	0.8048934
32.0	58.2	33.2	57.9	40.9	21.8	0.000000	0.0415	0.8489317
40.0	58.3	33.3	58.1	41.1	22.1	0.000000	0.0442	0.8969736
48.0	58.4	33.4	58.4	41.4	22.6	0.000000	0.0471	0.9495139
56.0	58.6	33.6	58.7	41.7	23.1	0.000000	0.0503	1.007117
64.0	58.7	33.7	59.0	42.0	23.6	0.000000	0.0537	1.070437
72.0	58.8	33.8	59.3	42.3	24.1	0.000000	0.0575	1.140231
80.0	58.9	33.9	59.6	42.6	24.5	0.000000	0.0615	1.21738
88.0	59.1	34.1	59.9	42.9	24.8	0.000000	0.0659	1.302904
96.0	59.2	34.2	60.2	43.2	25.1	0.000000	0.0707	1.398004
104.0	59.3	34.3	60.6	43.6	25.4	0.000000	0.0759	1.504085
112.0	59.5	34.5	60.9	43.9	25.7	0.000000	0.0815	1.622801
120.0	59.6	34.6	61.3	44.3	26.0	0.000000	0.0877	1.756111
128.0	59.8	34.8	61.7	44.7	26.4	0.000000	0.0944	1.906341
136.0	60.0	35.0	62.1	45.1	26.7	0.000000	0.1016	2.07627
144.0	60.1	35.1	62.5	45.5	27.1	0.000000	0.1095	2.269224
152.0	60.3	35.3	62.9	45.9	27.4	0.000000	0.1180	2.489209
160.0	60.5	35.5	63.3	46.3	27.8	0.000000	0.1272	2.741083
168.0	60.7	35.7	63.8	46.8	28.2	0.000000	0.1371	3.030749
176.0	60.8	35.8	64.3	47.3	28.7	0.000000	0.1478	3.365448
184.0	61.0	36.0	64.8	47.8	29.1	0.000000	0.1593	3.754087
192.0	61.3	36.3	65.3	48.3	29.6	0.000000	0.1717	4.207732
200.0	61.5	36.5	65.8	48.8	30.1	0.000000	0.1852	4.740187
208.0	61.7	36.7	66.4	49.4	30.6	0.000000	0.2002	5.368822
216.0	61.9	36.9	67.0	50.0	31.2	0.000000	0.2176	6.115681

224.0	62.2	37.2	67.6	50.6	31.8	0.000000	0.2389	7.008962
232.0	62.4	37.4	68.2	51.2	32.4	0.000000	0.2674	8.08508
240.0	62.7	37.7	68.8	51.8	33.1	0.000000	0.3087	9.391524
248.0	63.0	38.0	69.4	52.4	33.9	0.000000	0.3725	10.9908
256.0	63.3	38.3	70.2	53.2	34.7	0.000000	0.4736	12.9659
264.0	63.6	38.6	71.3	54.3	35.6	0.000000	0.6341	15.4276
272.0	63.9	38.9	72.3	55.3	36.5	0.000000	0.8855	18.5236
280.0	64.3	39.3	73.4	56.4	37.6	0.000000	1.2734	22.44777
288.0	64.7	39.7	75.4	58.4	38.7	0.000000	1.8603	27.44357
296.0	65.1	40.1	77.6	60.6	40.0	0.000000	2.7181	33.7835
304.0	65.5	40.5	79.9	62.9	41.4	0.000000	3.8898	41.68092
312.0	65.9	40.9	82.2	65.2	42.8	0.000000	5.2866	51.05289
320.0	66.2	41.2	84.1	67.1	43.9	0.000000	6.5335	61.10045
328.0	66.5	41.5	85.1	68.1	44.5	0.000000	6.9652	70.07807
336.0	66.6	41.6	84.7	67.7	44.3	3.881237	6.1060	76.13286
344.0	66.7	41.7	83.3	66.3	43.4	7.378945	4.3880	78.7833
352.0	66.7	41.7	82.4	65.4	42.9	7.437594	3.7132	78.75398
360.0	66.7	41.7	84.2	67.2	44.1	6.928437	5.2287	76.40276
368.0	66.7	41.7	85.2	68.2	44.7	6.302155	6.6267	71.25208
376.0	66.5	41.5	84.9	67.9	44.5	8.701845	6.7991	63.24398
384.0	66.2	41.2	83.4	66.4	43.5	11.088150	5.8387	53.75367
392.0	65.9	40.9	81.3	64.3	42.2	11.956620	4.4086	44.66465
400.0	65.5	40.5	78.9	61.9	40.8	11.462440	3.0551	37.10326
408.0	65.2	40.2	76.6	59.6	39.5	10.576420	1.9952	31.32805
416.0	64.9	39.9	74.4	57.4	38.3	9.692717	1.2419	27.16466
424.0	64.6	39.6	72.8	55.8	37.2	8.904259	0.7519	24.33087
432.0	64.4	39.4	71.7	54.7	36.2	8.220697	0.5216	22.57579
440.0	64.2	39.2	70.7	53.7	35.2	7.630820	0.5679	21.7206
448.0	64.1	39.1	69.6	52.6	34.4	7.119960	0.7550	21.6627
456.0	63.9	38.9	69.0	52.0	33.6	6.674685	1.0019	22.37094
464.0	63.9	38.9	68.3	51.3	33.6	6.283776	1.3076	23.88248
472.0	63.8	38.8	69.4	52.4	34.5	5.938134	1.6987	26.30486
480.0	63.9	38.9	71.3	54.3	35.6	5.630445	2.2173	29.82303
488.0	63.9	38.9	73.4	56.4	36.8	5.354822	2.9170	34.70566
496.0	64.0	39.0	75.6	58.6	38.0	5.106499	3.8525	41.29066
504.0	64.2	39.2	78.0	61.0	39.4	4.881591	5.0416	49.8963
512.0	64.4	39.4	80.2	63.2	40.8	4.676910	6.3719	60.54948
520.0	64.6	39.6	82.1	65.1	41.9	4.489813	7.4629	72.45572
528.0	64.8	39.8	83.1	66.1	42.6	4.318101	7.6747	83.61011
536.0	64.8	39.8	82.7	65.7	42.3	6.275081	6.5791	91.6563
544.0	64.8	39.8	81.3	64.3	41.4	7.609583	4.6573	95.69057
552.0	64.8	39.8	80.3	63.3	40.9	6.875250	3.9254	96.27303
560.0	64.7	39.7	82.2	65.2	42.0	6.914367	5.6129	93.64484
568.0	64.6	39.6	83.2	66.2	42.6	7.436357	7.2525	87.1632
576.0	64.3	39.3	82.8	65.8	42.4	9.302795	7.6796	76.83736
584.0	64.0	39.0	81.4	64.4	41.5	10.362660	6.9392	64.50469
592.0	63.6	38.6	79.2	62.2	40.2	9.330379	5.6554	52.56961
600.0	63.2	38.2	76.9	59.9	38.8	8.420425	4.3645	42.41496
608.0	62.8	37.8	74.6	57.6	37.5	7.707805	3.2988	34.31735
616.0	62.4	37.4	72.4	55.4	36.3	7.140966	2.4911	28.02243
624.0	62.1	37.1	70.4	53.4	35.1	6.677943	1.8997	23.15103
632.0	61.8	36.8	68.6	51.6	34.1	6.290591	1.4705	19.3599
640.0	61.5	36.5	67.0	50.0	33.2	5.960085	1.1575	16.37944
648.0	61.2	36.2	65.6	48.6	32.4	5.673482	0.9266	14.00851
656.0	60.9	35.9	64.4	47.4	31.6	5.421611	0.7539	12.09955
664.0	60.7	35.7	63.6	46.6	30.9	5.197786	0.6226	10.54449
672.0	60.5	35.5	62.8	45.8	30.2	4.997008	0.5213	9.263699
680.0	60.3	35.3	62.1	45.1	29.6	4.815454	0.4418	8.197955
688.0	60.1	35.1	61.4	44.4	29.0	4.650151	0.3785	7.30273
696.0	59.9	34.9	60.8	43.8	28.5	4.498738	0.3276	6.544189
704.0	59.7	34.7	60.1	43.1	27.9	4.359320	0.2860	5.896307

712.0	59.5	34.5	59.6	42.6	27.5	4.230350	0.2516	5.338872
720.0	59.4	34.4	59.0	42.0	27.0	4.110552	0.2230	4.855999
728.0	59.2	34.2	58.5	41.5	26.6	3.998866	0.1989	4.435115
736.0	59.1	34.1	58.0	41.0	26.1	3.894396	0.1784	4.066144
744.0	58.9	33.9	57.5	40.5	25.7	3.796384	0.1609	3.740963
752.0	58.8	33.8	57.1	40.1	25.3	3.704182	0.1458	3.452961
760.0	58.6	33.6	56.7	39.7	25.0	3.617230	0.1327	3.196719
768.0	58.5	33.5	56.3	39.3	24.6	3.535044	0.1212	2.967763
776.0	58.4	33.4	55.9	38.9	24.3	3.457198	0.1112	2.762379
784.0	58.3	33.3	55.5	38.5	24.0	3.383325	0.1023	2.577454
792.0	58.1	33.1	55.1	38.1	23.6	3.313096	0.0944	2.410371

Case #1 ROW EMF Cut @ Slatt Sub (Looking SW)

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Case #1 ROW EMF Cut @ Slatt Sub (Looking SW)
4-Exist 500kV_2-Exist 230 kV
1,0,18,26,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',430.00,35.000,2,1.602,18.000,317.55,120.000,0.720,0.000
'BN-SLB','A',450.00,62.500,2,1.602,18.000,317.55,240.000,0.720,0.000
'BN-SLA','A',470.00,35.000,2,1.602,18.000,317.55,0.000,0.720,0.000
'AS-MR2C','A',584.67,33.000,3,1.602,18.000,317.55,120.000,1.115,0.000
'AS-MR2B','A',600.00,51.667,3,1.602,18.000,317.55,240.000,1.115,0.000
'AS-MR2A','A',615.33,33.000,3,1.602,18.000,317.55,0.000,1.115,0.000
'AS-SL1C','A',694.67,33.000,3,1.602,18.000,317.55,120.000,1.995,0.000
'AS-SL1B','A',710.00,51.667,3,1.602,18.000,317.55,240.000,1.995,0.000
'AS-SL1A','A',725.33,33.000,3,1.602,18.000,317.55,0.000,1.995,0.000
'CS-SLC','A',800.00,33.000,2,1.602,18.000,317.55,120.000,1.921,0.000
'CS-SLB','A',820.00,61.500,2,1.602,18.000,317.55,240.000,1.921,0.000
'CS-SLA','A',840.00,33.000,2,1.602,18.000,317.55,0.000,1.921,0.000
'TR-ACB','A',931.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'TR-ACA','A',945.00,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'TR-ACC','A',958.17,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCB','A',1056.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'MN-JCC','A',1070.00,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCA','A',1083.17,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'BNSLSW1','A',437.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',462.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW1','A',588.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW2','A',612.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW1','A',698.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW2','A',722.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW1','A',808.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW2','A',832.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
100,0.0,13.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	53.8	28.8	48.7	31.7	16.5	0.000000	0.0498	2.672047
13.0	53.9	28.9	48.9	31.9	16.8	0.000000	0.0523	2.791129
26.0	54.1	29.1	49.2	32.2	17.0	0.000000	0.0551	2.918886
39.0	54.2	29.2	49.5	32.5	17.3	0.000000	0.0581	3.056241
52.0	54.3	29.3	49.8	32.8	17.6	0.000000	0.0614	3.204247
65.0	54.5	29.5	50.2	33.2	17.9	0.000000	0.0650	3.364112
78.0	54.6	29.6	50.5	33.5	18.1	0.000000	0.0689	3.537223
91.0	54.7	29.7	50.9	33.9	18.5	0.000000	0.0732	3.725203
104.0	54.9	29.9	51.2	34.2	18.8	0.000000	0.0780	3.929939
117.0	55.0	30.0	51.6	34.6	19.1	0.000000	0.0833	4.153635
130.0	55.2	30.2	52.0	35.0	19.6	0.000000	0.0892	4.398916
143.0	55.4	30.4	52.4	35.4	20.3	0.000000	0.0959	4.668897
156.0	55.5	30.5	52.9	35.9	21.1	0.000000	0.1034	4.967303
169.0	55.7	30.7	53.3	36.3	22.0	0.000000	0.1120	5.298656
182.0	55.9	30.9	53.8	36.8	22.6	0.000000	0.1217	5.668448
195.0	56.1	31.1	54.4	37.4	23.1	0.000000	0.1330	6.083464

208.0	56.3	31.3	54.9	37.9	23.6	0.000000	0.1461	6.55215
221.0	56.5	31.5	55.5	38.5	24.1	0.000000	0.1616	7.085163
234.0	56.7	31.7	56.1	39.1	24.6	0.000000	0.1800	7.696061
247.0	57.0	32.0	56.8	39.8	25.2	0.000000	0.2022	8.402441
260.0	57.2	32.2	57.5	40.5	25.8	0.000000	0.2296	9.227401
273.0	57.5	32.5	58.3	41.3	26.5	0.000000	0.2639	10.20188
286.0	57.8	32.8	59.2	42.2	27.2	0.000000	0.3078	11.36801
299.0	58.1	33.1	60.1	43.1	28.0	0.000000	0.3655	12.78444
312.0	58.5	33.5	61.2	44.2	28.9	0.000000	0.4439	14.53465
325.0	58.9	33.9	62.3	45.3	29.9	0.000000	0.5542	16.74047
338.0	59.3	34.3	63.5	46.5	31.0	0.000000	0.7156	19.58434
351.0	59.8	34.8	65.3	48.3	32.2	0.000000	0.9626	23.34694
364.0	60.3	35.3	67.7	50.7	33.6	0.000000	1.3578	28.46963
377.0	60.9	35.9	70.6	53.6	35.2	0.000000	2.0143	35.65133
390.0	61.6	36.6	73.9	56.9	37.1	0.000000	3.1185	45.94927
403.0	62.3	37.3	77.7	60.7	39.2	0.000000	4.8689	60.60526
416.0	63.1	38.1	81.3	64.3	41.4	0.000000	6.9783	79.38811
429.0	63.6	38.6	83.1	66.1	42.6	0.000000	7.6176	96.26535
442.0	63.9	38.9	81.7	64.7	41.7	3.659783	5.1532	102.2734
455.0	64.0	39.0	81.5	64.5	41.8	2.790349	4.3255	98.47961
468.0	63.9	38.9	83.6	66.6	43.1	3.740889	7.0571	87.79395
481.0	63.5	38.5	82.4	65.4	42.3	7.310978	6.9750	71.70584
494.0	62.9	37.9	79.1	62.1	40.3	5.932746	4.7643	58.03218
507.0	62.3	37.3	75.3	58.3	38.1	4.736882	2.5673	51.58398
520.0	61.7	36.7	71.8	54.8	36.1	3.952428	0.9255	51.8835
533.0	61.4	36.4	68.9	51.9	34.4	3.403787	0.8698	58.02707
546.0	61.2	36.2	66.3	49.3	33.0	2.997705	2.5387	70.44666
559.0	61.1	36.1	69.9	52.9	31.7	2.684144	4.9138	90.50982
572.0	61.1	36.1	73.8	56.8	33.9	2.434136	7.6000	117.1852
585.0	61.2	36.2	75.5	58.5	35.0	2.229760	7.9526	138.5792
598.0	61.2	36.2	73.6	56.6	33.7	3.720599	4.9248	138.4065
611.0	61.1	36.1	75.8	58.8	35.4	3.889428	6.9230	118.4808
624.0	61.0	36.0	75.2	58.2	34.9	5.454321	7.6768	91.21669
637.0	60.9	35.9	71.7	54.7	32.7	4.704674	4.9565	79.26922
650.0	60.8	35.8	67.6	50.6	30.4	3.947150	2.0175	90.60812
663.0	60.9	35.9	68.4	51.4	30.8	3.442078	2.6254	120.2135
676.0	61.1	36.1	72.5	55.5	33.2	3.079699	5.7438	167.9345
689.0	61.4	36.4	75.6	58.6	35.2	2.803469	7.9771	226.202
702.0	61.6	36.6	75.3	58.3	35.0	4.112836	6.2530	263.9987
715.0	61.8	36.8	74.8	57.8	34.7	3.934374	5.4695	259.9627
728.0	62.0	37.0	75.9	58.9	35.4	4.414231	7.9412	216.8595
741.0	62.2	37.2	73.4	56.4	35.7	5.589014	6.3792	156.1688
754.0	62.5	37.5	73.4	56.4	37.6	4.664436	3.2007	115.2312
767.0	63.0	38.0	77.1	60.1	39.7	4.045440	2.1197	114.8107
780.0	63.6	38.6	81.2	64.2	42.1	3.613855	4.9746	155.7326
793.0	64.3	39.3	84.5	67.5	44.2	3.291372	7.6049	223.0749
806.0	64.5	39.5	84.7	67.7	44.3	6.150002	6.8486	283.7746
819.0	64.4	39.4	81.5	64.5	42.3	6.884948	3.9841	312.8488
832.0	64.3	39.3	83.2	66.2	42.9	6.538265	6.8364	313.6202
845.0	63.9	38.9	83.7	66.7	43.2	8.119414	8.5468	275.0206
858.0	63.2	38.2	80.7	63.7	41.3	9.077871	6.7600	208.9227
871.0	62.4	37.4	76.6	59.6	38.9	7.487047	4.3572	150.3512
884.0	61.6	36.6	72.8	55.8	36.7	6.444797	2.7887	109.4999
897.0	61.0	36.0	69.5	52.5	34.9	5.718822	2.1454	82.14787
910.0	60.5	35.5	66.7	49.7	33.3	5.177959	2.4078	78.45604
923.0	60.1	35.1	67.2	50.2	32.0	4.755051	3.0722	95.71431
936.0	59.7	34.7	70.9	53.9	30.9	4.647995	2.3436	108.9861
949.0	59.4	34.4	72.1	55.1	31.8	4.886214	1.2136	102.8867
962.0	59.0	34.0	69.6	52.6	29.2	5.042184	2.4679	71.19932
975.0	58.6	33.6	65.5	48.5	27.9	4.771629	1.9484	37.51976
988.0	58.2	33.2	60.2	43.2	27.1	4.295788	1.0234	32.76028

1001	57.9	32.9	57.2	40.2	26.4	3.968667	0.5329	32.83266
1014	57.7	32.7	56.4	39.4	25.8	3.718739	0.6890	35.58214
1027	57.5	32.5	59.3	42.3	25.2	3.515338	1.2887	42.65116
1040	57.3	32.3	64.6	47.6	26.2	3.343347	2.2229	56.65002
1053	57.3	32.3	68.8	51.8	29.4	3.194212	2.7248	75.917
1066	57.2	32.2	72.5	55.5	32.2	3.549894	1.3483	84.45936
1079	57.0	32.0	71.3	54.3	31.3	4.179482	1.9992	78.01527
1092	56.7	31.7	67.7	50.7	28.1	4.180418	2.6800	59.18643
1105	56.3	31.3	62.6	45.6	25.2	3.695493	1.8332	39.64344
1118	56.0	31.0	57.6	40.6	22.9	3.379356	1.0502	27.41246
1131	55.8	30.8	53.6	36.6	21.0	3.161515	0.6046	20.34201
1144	55.6	30.6	51.0	34.0	19.4	2.995020	0.3646	16.02422
1157	55.4	30.4	50.6	33.6	18.2	2.859454	0.2314	13.18926
1170	55.2	30.2	50.2	33.2	17.9	2.744527	0.1544	11.20544
1183	55.0	30.0	49.8	32.8	17.6	2.644405	0.1085	9.743659
1196	54.9	29.9	49.5	32.5	17.3	2.555487	0.0808	8.62133
1209	54.7	29.7	49.2	32.2	17.0	2.475385	0.0641	7.730916
1222	54.6	29.6	48.8	31.8	16.7	2.402440	0.0540	7.005637
1235	54.4	29.4	48.5	31.5	16.4	2.335445	0.0479	6.40212
1248	54.3	29.3	48.2	31.2	16.2	2.273491	0.0440	5.891049
1261	54.1	29.1	47.9	30.9	15.9	2.215875	0.0414	5.451939
1274	54.0	29.0	47.7	30.7	15.5	2.162042	0.0396	5.070043
1287	53.9	28.9	47.4	30.4	15.1	2.111543	0.0381	4.73448

Case #2 ROW EMF Cut @ Slatt Sub (Looking SW)

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Case #2 ROW EMF Cut @ Slatt Sub (Looking SW)
4-Exist 500kV_2-Exist 230 kV
1,0,18,26,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',430.00,35.000,2,1.602,18.000,317.55,120.000,1.267,0.000
'BN-SLB','A',450.00,62.500,2,1.602,18.000,317.55,240.000,1.267,0.000
'BN-SLA','A',470.00,35.000,2,1.602,18.000,317.55,0.000,1.267,0.000
'AS-MR2C','A',584.67,33.000,3,1.602,18.000,317.55,120.000,1.115,0.000
'AS-MR2B','A',600.00,51.667,3,1.602,18.000,317.55,240.000,1.115,0.000
'AS-MR2A','A',615.33,33.000,3,1.602,18.000,317.55,0.000,1.115,0.000
'AS-SL1C','A',694.67,33.000,3,1.602,18.000,317.55,120.000,1.995,0.000
'AS-SL1B','A',710.00,51.667,3,1.602,18.000,317.55,240.000,1.995,0.000
'AS-SL1A','A',725.33,33.000,3,1.602,18.000,317.55,0.000,1.995,0.000
'CS-SLC','A',800.00,33.000,2,1.602,18.000,317.55,120.000,1.921,0.000
'CS-SLB','A',820.00,61.500,2,1.602,18.000,317.55,240.000,1.921,0.000
'CS-SLA','A',840.00,33.000,2,1.602,18.000,317.55,0.000,1.921,0.000
'TR-ACB','A',931.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'TR-ACA','A',945.00,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'TR-ACC','A',958.17,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCB','A',1056.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'MN-JCC','A',1070.00,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCA','A',1083.17,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'BNSLSW1','A',437.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',462.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW1','A',588.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW2','A',612.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW1','A',698.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW2','A',722.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW1','A',808.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW2','A',832.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
100,0.0,13.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBµV/M	RADIO INTERFER (FAIR) L50 DBµV/M	TVI TOTAL RAIN DBµV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	53.8	28.8	48.7	31.7	16.5	0.000000	0.0498	3.284668
13.0	53.9	28.9	48.9	31.9	16.8	0.000000	0.0523	3.440832
26.0	54.1	29.1	49.2	32.2	17.0	0.000000	0.0551	3.609143
39.0	54.2	29.2	49.5	32.5	17.3	0.000000	0.0581	3.790978
52.0	54.3	29.3	49.8	32.8	17.6	0.000000	0.0614	3.987898
65.0	54.5	29.5	50.2	33.2	17.9	0.000000	0.0650	4.201728
78.0	54.6	29.6	50.5	33.5	18.1	0.000000	0.0689	4.434576
91.0	54.7	29.7	50.9	33.9	18.5	0.000000	0.0732	4.688913
104.0	54.9	29.9	51.2	34.2	18.8	0.000000	0.0780	4.967649
117.0	55.0	30.0	51.6	34.6	19.1	0.000000	0.0833	5.274199
130.0	55.2	30.2	52.0	35.0	19.6	0.000000	0.0892	5.612657
143.0	55.4	30.4	52.4	35.4	20.3	0.000000	0.0959	5.987927
156.0	55.5	30.5	52.9	35.9	21.1	0.000000	0.1034	6.405918
169.0	55.7	30.7	53.3	36.3	22.0	0.000000	0.1120	6.873856
182.0	55.9	30.9	53.8	36.8	22.6	0.000000	0.1217	7.400597

195.0	56.1	31.1	54.4	37.4	23.1	0.000000	0.1330	7.997177
208.0	56.3	31.3	54.9	37.9	23.6	0.000000	0.1461	8.677444
221.0	56.5	31.5	55.5	38.5	24.1	0.000000	0.1616	9.458995
234.0	56.7	31.7	56.1	39.1	24.6	0.000000	0.1800	10.36446
247.0	57.0	32.0	56.8	39.8	25.2	0.000000	0.2022	11.42343
260.0	57.2	32.2	57.5	40.5	25.8	0.000000	0.2296	12.67512
273.0	57.5	32.5	58.3	41.3	26.5	0.000000	0.2639	14.17249
286.0	57.8	32.8	59.2	42.2	27.2	0.000000	0.3078	15.98836
299.0	58.1	33.1	60.1	43.1	28.0	0.000000	0.3655	18.22505
312.0	58.5	33.5	61.2	44.2	28.9	0.000000	0.4439	21.02968
325.0	58.9	33.9	62.3	45.3	29.9	0.000000	0.5542	24.61929
338.0	59.3	34.3	63.5	46.5	31.0	0.000000	0.7156	29.32282
351.0	59.8	34.8	65.3	48.3	32.2	0.000000	0.9626	35.65323
364.0	60.3	35.3	67.7	50.7	33.6	0.000000	1.3578	44.43053
377.0	60.9	35.9	70.6	53.6	35.2	0.000000	2.0143	56.98166
390.0	61.6	36.6	73.9	56.9	37.1	0.000000	3.1185	75.3831
403.0	62.3	37.3	77.7	60.7	39.2	0.000000	4.8689	102.2827
416.0	63.1	38.1	81.3	64.3	41.4	0.000000	6.9783	138.0826
429.0	63.6	38.6	83.1	66.1	42.6	0.000000	7.6176	172.6893
442.0	63.9	38.9	81.7	64.7	41.7	3.659783	5.1532	188.9269
455.0	64.0	39.0	81.5	64.5	41.8	2.790349	4.3255	186.2729
468.0	63.9	38.9	83.6	66.6	43.1	3.740889	7.0571	167.6926
481.0	63.5	38.5	82.4	65.4	42.3	7.310978	6.9750	134.0826
494.0	62.9	37.9	79.1	62.1	40.3	5.932746	4.7643	100.7297
507.0	62.3	37.3	75.3	58.3	38.1	4.736882	2.5673	78.6966
520.0	61.7	36.7	71.8	54.8	36.1	3.952428	0.9255	68.1807
533.0	61.4	36.4	68.9	51.9	34.4	3.403787	0.8698	67.05523
546.0	61.2	36.2	66.3	49.3	33.0	2.997705	2.5387	74.39182
559.0	61.1	36.1	69.9	52.9	31.7	2.684144	4.9138	90.48364
572.0	61.1	36.1	73.8	56.8	33.9	2.434136	7.6000	113.7656
585.0	61.2	36.2	75.5	58.5	35.0	2.229760	7.9526	132.9168
598.0	61.2	36.2	73.6	56.6	33.7	3.720599	4.9248	132.9342
611.0	61.1	36.1	75.8	58.8	35.4	3.889428	6.9230	115.7946
624.0	61.0	36.0	75.2	58.2	34.9	5.454321	7.6768	92.62822
637.0	60.9	35.9	71.7	54.7	32.7	4.704674	4.9565	82.66227
650.0	60.8	35.8	67.6	50.6	30.4	3.947150	2.0175	93.13669
663.0	60.9	35.9	68.4	51.4	30.8	3.442078	2.6254	121.3389
676.0	61.1	36.1	72.5	55.5	33.2	3.079699	5.7438	167.7528
689.0	61.4	36.4	75.6	58.6	35.2	2.803469	7.9771	224.8915
702.0	61.6	36.6	75.3	58.3	35.0	4.112836	6.2530	262.1228
715.0	61.8	36.8	74.8	57.8	34.7	3.934374	5.4695	258.3767
728.0	62.0	37.0	75.9	58.9	35.4	4.414231	7.9412	216.2533
741.0	62.2	37.2	73.4	56.4	35.7	5.589014	6.3792	156.7081
754.0	62.5	37.5	73.4	56.4	37.6	4.664436	3.2007	116.4953
767.0	63.0	38.0	77.1	60.1	39.7	4.045440	2.1197	115.8012
780.0	63.6	38.6	81.2	64.2	42.1	3.613855	4.9746	155.8891
793.0	64.3	39.3	84.5	67.5	44.2	3.291372	7.6049	222.5475
806.0	64.5	39.5	84.7	67.7	44.3	6.150002	6.8486	282.8862
819.0	64.4	39.4	81.5	64.5	42.3	6.884948	3.9841	311.9656
832.0	64.3	39.3	83.2	66.2	42.9	6.538265	6.8364	313.0017
845.0	63.9	38.9	83.7	66.7	43.2	8.119414	8.5468	274.815
858.0	63.2	38.2	80.7	63.7	41.3	9.077871	6.7600	209.0781
871.0	62.4	37.4	76.6	59.6	38.9	7.487047	4.3572	150.7134
884.0	61.6	36.6	72.8	55.8	36.7	6.444797	2.7887	109.9577
897.0	61.0	36.0	69.5	52.5	34.9	5.718822	2.1454	82.64429
910.0	60.5	35.5	66.7	49.7	33.3	5.177959	2.4078	78.83949
923.0	60.1	35.1	67.2	50.2	32.0	4.755051	3.0722	96.1399
936.0	59.7	34.7	70.9	53.9	30.9	4.647995	2.3436	109.4399
949.0	59.4	34.4	72.1	55.1	31.8	4.886214	1.2136	103.3101
962.0	59.0	34.0	69.6	52.6	29.2	5.042184	2.4679	71.48958
975.0	58.6	33.6	65.5	48.5	27.9	4.771629	1.9484	37.94515

988.0	58.2	33.2	60.2	43.2	27.1	4.295788	1.0234	33.10315
1001	57.9	32.9	57.2	40.2	26.4	3.968667	0.5329	33.1661
1014	57.7	32.7	56.4	39.4	25.8	3.718739	0.6890	35.91147
1027	57.5	32.5	59.3	42.3	25.2	3.515338	1.2887	42.96996
1040	57.3	32.3	64.6	47.6	26.2	3.343347	2.2229	56.93568
1053	57.3	32.3	68.8	51.8	29.4	3.194212	2.7248	76.08186
1066	57.2	32.2	72.5	55.5	32.2	3.549894	1.3483	84.36305
1079	57.0	32.0	71.3	54.3	31.3	4.179482	1.9992	77.73599
1092	56.7	31.7	67.7	50.7	28.1	4.180418	2.6800	59.00068
1105	56.3	31.3	62.6	45.6	25.2	3.695493	1.8332	39.62696
1118	56.0	31.0	57.6	40.6	22.9	3.379356	1.0502	27.50513
1131	55.8	30.8	53.6	36.6	21.0	3.161515	0.6046	20.49192
1144	55.6	30.6	51.0	34.0	19.4	2.995020	0.3646	16.20255
1157	55.4	30.4	50.6	33.6	18.2	2.859454	0.2314	13.38088
1170	55.2	30.2	50.2	33.2	17.9	2.744527	0.1544	11.40231
1183	55.0	30.0	49.8	32.8	17.6	2.644405	0.1085	9.941367
1196	54.9	29.9	49.5	32.5	17.3	2.555487	0.0808	8.817407
1209	54.7	29.7	49.2	32.2	17.0	2.475385	0.0641	7.92395
1222	54.6	29.6	48.8	31.8	16.7	2.402440	0.0540	7.194828
1235	54.4	29.4	48.5	31.5	16.4	2.335445	0.0479	6.587031
1248	54.3	29.3	48.2	31.2	16.2	2.273491	0.0440	6.071454
1261	54.1	29.1	47.9	30.9	15.9	2.215875	0.0414	5.627753
1274	54.0	29.0	47.7	30.7	15.5	2.162042	0.0396	5.241267
1287	53.9	28.9	47.4	30.4	15.1	2.111543	0.0381	4.901162

Case #3 ROW EMF Cut @ Slatt Sub (Looking SW)

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Case #3 ROW EMF Cut @ Slatt Sub (Looking SW)
1-New 500 kV SC_4-Exist 500kV_2-Exist 230 kV
1,0,21,31,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',430.00,35.000,2,1.602,18.000,317.55,120.000,0.634,0.000
'BN-SLB','A',450.00,62.500,2,1.602,18.000,317.55,240.000,0.634,0.000
'BN-SLA','A',470.00,35.000,2,1.602,18.000,317.55,0.000,0.634,0.000
'AS-MR2C','A',584.67,33.000,3,1.602,18.000,317.55,120.000,1.115,0.000
'AS-MR2B','A',600.00,51.667,3,1.602,18.000,317.55,240.000,1.115,0.000
'AS-MR2A','A',615.33,33.000,3,1.602,18.000,317.55,0.000,1.115,0.000
'AS-SL1C','A',694.67,33.000,3,1.602,18.000,317.55,120.000,1.995,0.000
'AS-SL1B','A',710.00,51.667,3,1.602,18.000,317.55,240.000,1.995,0.000
'AS-SL1A','A',725.33,33.000,3,1.602,18.000,317.55,0.000,1.995,0.000
'CS-SLC','A',800.00,33.000,2,1.602,18.000,317.55,120.000,1.921,0.000
'CS-SLB','A',820.00,61.500,2,1.602,18.000,317.55,240.000,1.921,0.000
'CS-SLA','A',840.00,33.000,2,1.602,18.000,317.55,0.000,1.921,0.000
'TR-ACB','A',931.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'TR-ACA','A',945.00,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'TR-ACC','A',958.17,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCB','A',1056.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'MN-JCC','A',1070.00,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCA','A',1083.17,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'CT-SL1C','A',280.00,35.000,2,1.602,18.000,317.55,120.000,0.634,0.000
'CT-SL1B','A',300.00,62.500,2,1.602,18.000,317.55,240.000,0.634,0.000
'CT-SL1A','A',320.00,35.000,2,1.602,18.000,317.55,0.000,0.634,0.000
'BNSLSW1','A',437.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',462.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW1','A',588.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW2','A',612.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW1','A',698.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW2','A',722.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW1','A',808.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW2','A',832.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSL1SW1','A',287.08,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSL1SW2','A',312.92,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,13.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBμV/M	RADIO INTERFER (FAIR) L50 DBμV/M	TVI TOTAL RAIN DBμV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	56.7	31.7	52.7	35.7	20.7	0.000000	0.1047	4.168147
13.0	56.8	31.8	53.1	36.1	21.6	0.000000	0.1128	4.428603
26.0	57.0	32.0	53.6	36.6	22.4	0.000000	0.1221	4.718512
39.0	57.2	32.2	54.1	37.1	22.8	0.000000	0.1327	5.043033
52.0	57.4	32.4	54.7	37.7	23.3	0.000000	0.1449	5.408572
65.0	57.6	32.6	55.2	38.2	23.8	0.000000	0.1593	5.823188
78.0	57.8	32.8	55.8	38.8	24.4	0.000000	0.1763	6.297146
91.0	58.0	33.0	56.5	39.5	24.9	0.000000	0.1966	6.843695
104.0	58.2	33.2	57.2	40.2	25.5	0.000000	0.2214	7.480201
117.0	58.5	33.5	58.0	41.0	26.2	0.000000	0.2521	8.229786

130.0	58.7	33.7	58.8	41.8	26.9	0.000000	0.2910	9.123829
143.0	59.0	34.0	59.7	42.7	27.7	0.000000	0.3415	10.20576
156.0	59.3	34.3	60.7	43.7	28.5	0.000000	0.4091	11.53699
169.0	59.7	34.7	61.8	44.8	29.4	0.000000	0.5025	13.20653
182.0	60.0	35.0	63.0	46.0	30.4	0.000000	0.6369	15.34676
195.0	60.4	35.4	64.3	47.3	31.6	0.000000	0.8384	18.16
208.0	60.9	35.9	66.5	49.5	32.9	0.000000	1.1545	21.96372
221.0	61.4	36.4	69.2	52.2	34.4	0.000000	1.6717	27.26521
234.0	62.0	37.0	72.3	55.3	36.2	0.000000	2.5415	34.86721
247.0	62.6	37.6	75.9	58.9	38.2	0.000000	3.9792	45.91094
260.0	63.4	38.4	79.7	62.7	40.4	0.000000	6.0353	61.27617
273.0	64.0	39.0	82.6	65.6	42.2	0.000000	7.6866	78.7048
286.0	64.4	39.4	82.7	65.7	42.3	2.113384	6.6005	90.13557
299.0	64.5	39.5	80.0	63.0	40.8	3.230059	3.8338	91.41544
312.0	64.6	39.6	83.0	66.0	42.7	3.398721	5.9437	85.48371
325.0	64.5	39.5	83.4	66.4	43.0	5.081089	7.4096	72.34307
338.0	64.2	39.2	80.8	63.8	41.3	6.687071	5.8347	56.31535
351.0	63.8	38.8	77.0	60.0	39.1	5.238978	3.4482	44.71766
364.0	63.5	38.5	73.4	56.4	37.0	4.288869	1.5270	39.34592
377.0	63.5	38.5	71.0	54.0	35.6	3.644732	0.6315	39.24463
390.0	63.6	38.6	74.4	57.4	37.5	3.179448	2.1061	43.72765
403.0	64.0	39.0	78.1	61.1	39.7	2.826643	4.2047	52.77955
416.0	64.4	39.4	81.7	64.7	41.9	2.549221	6.5639	65.66031
429.0	64.7	39.7	83.6	66.6	43.0	2.324892	7.3760	77.53564
442.0	64.8	39.8	82.2	65.2	42.1	6.080088	5.0302	81.81352
455.0	64.8	39.8	81.5	64.5	41.7	4.987078	4.3502	79.8014
468.0	64.6	39.6	83.5	66.5	43.0	5.706618	7.0950	73.74792
481.0	64.2	39.2	82.4	65.4	42.3	9.084661	7.0040	63.84153
494.0	63.7	38.7	79.0	62.0	40.2	7.600403	4.7890	55.07989
507.0	63.1	38.1	75.2	58.2	38.0	6.315050	2.5897	51.24166
520.0	62.6	37.6	71.8	54.8	36.0	5.450071	0.9410	52.58073
533.0	62.2	37.2	68.8	51.8	34.4	4.828875	0.8402	59.00124
546.0	62.0	37.0	66.3	49.3	32.9	4.357244	2.5126	71.35241
559.0	61.9	36.9	69.9	52.9	31.7	3.984237	4.8924	91.14389
572.0	61.9	36.9	73.8	56.8	33.9	3.680094	7.5842	117.3629
585.0	61.9	36.9	75.6	58.6	35.0	3.426215	7.9419	138.1952
598.0	61.9	36.9	73.6	56.6	33.8	4.877769	4.9178	137.6508
611.0	61.8	36.8	75.8	58.8	35.4	4.999494	6.9219	117.8258
624.0	61.7	36.7	75.2	58.2	34.9	6.523602	7.6766	91.22074
637.0	61.5	36.5	71.7	54.7	32.7	5.738190	4.9562	79.90892
650.0	61.5	36.5	67.6	50.6	30.4	4.947477	2.0147	91.25568
663.0	61.5	36.5	68.4	51.4	30.8	4.411416	2.6190	120.6008
676.0	61.6	36.6	72.5	55.5	33.2	4.020030	5.7389	167.9898
689.0	61.9	36.9	75.6	58.6	35.2	3.716593	7.9734	225.9011
702.0	62.1	37.1	75.3	58.3	35.0	5.002164	6.2500	263.4549
715.0	62.2	37.2	74.8	57.8	34.7	4.799504	5.4679	259.4309
728.0	62.4	37.4	75.9	58.9	35.4	5.254053	7.9406	216.5974
741.0	62.5	37.5	73.4	56.4	35.7	6.407714	6.3786	156.2991
754.0	62.8	37.8	73.4	56.4	37.6	5.462908	3.1994	115.6712
767.0	63.3	38.3	77.1	60.1	39.7	4.824739	2.1159	115.2097
780.0	63.9	38.9	81.2	64.2	42.1	4.374941	4.9717	155.8287
793.0	64.5	39.5	84.5	67.5	44.2	4.035131	7.6026	222.886
806.0	64.7	39.7	84.7	67.7	44.3	6.879632	6.8465	283.4118
819.0	64.6	39.6	81.5	64.5	42.3	7.599560	3.9819	312.4634
832.0	64.5	39.5	83.2	66.2	42.9	7.234957	6.8356	313.3313
845.0	64.1	39.1	83.7	66.7	43.2	8.800439	8.5462	274.9063
858.0	63.4	38.4	80.7	63.7	41.3	9.745729	6.7596	208.9737
871.0	62.6	37.6	76.6	59.6	38.9	8.141723	4.3574	150.5048
884.0	61.9	36.9	72.8	55.8	36.7	7.086907	2.7900	109.7065
897.0	61.3	36.3	69.5	52.5	34.9	6.348898	2.1484	82.38035
910.0	60.9	35.9	66.7	49.7	33.3	5.796478	2.4117	78.64283

923.0	60.5	35.5	67.2	50.2	32.0	5.362455	3.0756	95.93073
936.0	60.1	35.1	70.9	53.9	30.9	5.244270	2.3460	109.2257
949.0	59.8	34.8	72.1	55.1	31.8	5.472145	1.2112	103.1164
962.0	59.5	34.5	69.6	52.6	29.2	5.618825	2.4649	71.36214
975.0	59.1	34.1	65.5	48.5	27.9	5.338970	1.9451	37.75267
988.0	58.8	33.8	60.2	43.2	27.1	4.853728	1.0203	32.94283
1001	58.5	33.5	57.2	40.2	26.4	4.517613	0.5322	33.01387
1014	58.3	33.3	56.4	39.4	25.8	4.259025	0.6922	35.76507
1027	58.1	33.1	59.3	42.3	25.2	4.047267	1.2925	42.83233
1040	58.0	33.0	64.6	47.6	26.3	3.867201	2.2262	56.81702
1053	57.9	32.9	68.8	51.8	29.4	3.710255	2.7273	76.01874
1066	57.8	32.8	72.5	55.5	32.2	4.057522	1.3489	84.40842
1079	57.6	32.6	71.3	54.3	31.3	4.680930	1.9972	77.84992
1092	57.3	32.3	67.7	50.7	28.1	4.674845	2.6782	59.07091
1105	57.0	32.0	62.7	45.7	25.2	4.182894	1.8313	39.62832
1118	56.8	31.8	57.6	40.6	22.9	3.860002	1.0482	27.46462
1131	56.5	31.5	53.6	36.6	21.0	3.635636	0.6026	20.4309
1144	56.3	31.3	51.0	34.0	19.4	3.462820	0.3628	16.13239
1157	56.2	31.2	50.6	33.6	18.2	3.321116	0.2299	13.30732
1170	56.0	31.0	50.2	33.2	17.9	3.200227	0.1534	11.32827
1183	55.8	30.8	49.8	32.8	17.6	3.094311	0.1082	9.868345
1196	55.7	30.7	49.5	32.5	17.3	2.999756	0.0813	8.746193
1209	55.6	30.6	49.1	32.1	17.0	2.914171	0.0653	7.854939
1222	55.4	30.4	48.8	31.8	16.7	2.835886	0.0559	7.128205
1235	55.3	30.3	48.5	31.5	16.4	2.763691	0.0503	6.522856
1248	55.2	30.2	48.2	31.2	16.2	2.696669	0.0468	6.00972
1261	55.0	30.0	47.9	30.9	15.9	2.634115	0.0445	5.56841
1274	54.9	29.9	47.6	30.6	15.5	2.575467	0.0428	5.184241
1287	54.8	29.8	47.4	30.4	15.0	2.520271	0.0413	4.846375

Case #4 ROW EMF Cut @ Slatt Sub (Looking SW)

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Case #4 ROW EMF Cut @ Slatt Sub (Looking SW)
1-New 500 kV SC_4-Exist 500kV_2-Exist 230 kV
1,0,21,31,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',430.00,35.000,2,1.602,18.000,317.55,120.000,0.907,0.000
'BN-SLB','A',450.00,62.500,2,1.602,18.000,317.55,240.000,0.907,0.000
'BN-SLA','A',470.00,35.000,2,1.602,18.000,317.55,0.000,0.907,0.000
'AS-MR2C','A',584.67,33.000,3,1.602,18.000,317.55,120.000,1.115,0.000
'AS-MR2B','A',600.00,51.667,3,1.602,18.000,317.55,240.000,1.115,0.000
'AS-MR2A','A',615.33,33.000,3,1.602,18.000,317.55,0.000,1.115,0.000
'AS-SL1C','A',694.67,33.000,3,1.602,18.000,317.55,120.000,1.995,0.000
'AS-SL1B','A',710.00,51.667,3,1.602,18.000,317.55,240.000,1.995,0.000
'AS-SL1A','A',725.33,33.000,3,1.602,18.000,317.55,0.000,1.995,0.000
'CS-SLC','A',800.00,33.000,2,1.602,18.000,317.55,120.000,1.921,0.000
'CS-SLB','A',820.00,61.500,2,1.602,18.000,317.55,240.000,1.921,0.000
'CS-SLA','A',840.00,33.000,2,1.602,18.000,317.55,0.000,1.921,0.000
'TR-ACB','A',931.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'TR-ACA','A',945.00,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'TR-ACC','A',958.17,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCB','A',1056.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'MN-JCC','A',1070.00,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCA','A',1083.17,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'CT-SL1C','A',280.00,35.000,2,1.602,18.000,317.55,120.000,0.907,0.000
'CT-SL1B','A',300.00,62.500,2,1.602,18.000,317.55,240.000,0.907,0.000
'CT-SL1A','A',320.00,35.000,2,1.602,18.000,317.55,0.000,0.907,0.000
'BNSLSW1','A',437.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNSLSW2','A',462.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW1','A',588.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW2','A',612.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW1','A',698.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW2','A',722.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW1','A',808.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW2','A',832.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSL1SW1','A',287.08,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSL1SW2','A',312.92,99.125,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,13.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBµV/M	RADIO INTERFER (FAIR) L50 DBµV/M	TVI TOTAL RAIN DBµV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	56.7	31.7	52.7	35.7	20.7	0.000000	0.1047	5.164931
13.0	56.8	31.8	53.1	36.1	21.6	0.000000	0.1128	5.508074
26.0	57.0	32.0	53.6	36.6	22.4	0.000000	0.1221	5.891743
39.0	57.2	32.2	54.1	37.1	22.8	0.000000	0.1327	6.323224
52.0	57.4	32.4	54.7	37.7	23.3	0.000000	0.1449	6.811584
65.0	57.6	32.6	55.2	38.2	23.8	0.000000	0.1593	7.368252
78.0	57.8	32.8	55.8	38.8	24.4	0.000000	0.1763	8.007832
91.0	58.0	33.0	56.5	39.5	24.9	0.000000	0.1966	8.749212
104.0	58.2	33.2	57.2	40.2	25.5	0.000000	0.2214	9.617215
117.0	58.5	33.5	58.0	41.0	26.2	0.000000	0.2521	10.64497

130.0	58.7	33.7	58.8	41.8	26.9	0.000000	0.2910	11.87754
143.0	59.0	34.0	59.7	42.7	27.7	0.000000	0.3415	13.37745
156.0	59.3	34.3	60.7	43.7	28.5	0.000000	0.4091	15.23332
169.0	59.7	34.7	61.8	44.8	29.4	0.000000	0.5025	17.57399
182.0	60.0	35.0	63.0	46.0	30.4	0.000000	0.6369	20.59158
195.0	60.4	35.4	64.3	47.3	31.6	0.000000	0.8384	24.58071
208.0	60.9	35.9	66.5	49.5	32.9	0.000000	1.1545	30.00541
221.0	61.4	36.4	69.2	52.2	34.4	0.000000	1.6717	37.61065
234.0	62.0	37.0	72.3	55.3	36.2	0.000000	2.5415	48.5832
247.0	62.6	37.6	75.9	58.9	38.2	0.000000	3.9792	64.63142
260.0	63.4	38.4	79.7	62.7	40.4	0.000000	6.0353	87.14639
273.0	64.0	39.0	82.6	65.6	42.2	0.000000	7.6866	113.0201
286.0	64.4	39.4	82.7	65.7	42.3	2.113384	6.6005	130.5239
299.0	64.5	39.5	80.0	63.0	40.8	3.230059	3.8338	133.1758
312.0	64.6	39.6	83.0	66.0	42.7	3.398721	5.9437	124.7804
325.0	64.5	39.5	83.4	66.4	43.0	5.081089	7.4096	105.0691
338.0	64.2	39.2	80.8	63.8	41.3	6.687071	5.8347	80.49359
351.0	63.8	38.8	77.0	60.0	39.1	5.238978	3.4482	62.19289
364.0	63.5	38.5	73.4	56.4	37.0	4.288869	1.5270	53.16097
377.0	63.5	38.5	71.0	54.0	35.6	3.644732	0.6315	52.2171
390.0	63.6	38.6	74.4	57.4	37.5	3.179448	2.1061	58.44566
403.0	64.0	39.0	78.1	61.1	39.7	2.826643	4.2047	71.97405
416.0	64.4	39.4	81.7	64.7	41.9	2.549221	6.5639	92.15106
429.0	64.7	39.7	83.6	66.6	43.0	2.324892	7.3760	112.3271
442.0	64.8	39.8	82.2	65.2	42.1	6.080088	5.0302	122.0746
455.0	64.8	39.8	81.5	64.5	41.7	4.987078	4.3502	121.5807
468.0	64.6	39.6	83.5	66.5	43.0	5.706618	7.0950	112.6074
481.0	64.2	39.2	82.4	65.4	42.3	9.084661	7.0040	94.61461
494.0	63.7	38.7	79.0	62.0	40.2	7.600403	4.7890	76.32438
507.0	63.1	38.1	75.2	58.2	38.0	6.315050	2.5897	64.93453
520.0	62.6	37.6	71.8	54.8	36.0	5.450071	0.9410	61.08576
533.0	62.2	37.2	68.8	51.8	34.4	4.828875	0.8402	63.97461
546.0	62.0	37.0	66.3	49.3	32.9	4.357244	2.5126	73.72672
559.0	61.9	36.9	69.9	52.9	31.7	3.984237	4.8924	91.31963
572.0	61.9	36.9	73.8	56.8	33.9	3.680094	7.5842	115.4929
585.0	61.9	36.9	75.6	58.6	35.0	3.426215	7.9419	134.8266
598.0	61.9	36.9	73.6	56.6	33.8	4.877769	4.9178	134.2186
611.0	61.8	36.8	75.8	58.8	35.4	4.999494	6.9219	116.0154
624.0	61.7	36.7	75.2	58.2	34.9	6.523602	7.6766	92.03574
637.0	61.5	36.5	71.7	54.7	32.7	5.738190	4.9562	82.10941
650.0	61.5	36.5	67.6	50.6	30.4	4.947477	2.0147	92.96774
663.0	61.5	36.5	68.4	51.4	30.8	4.411416	2.6190	121.4103
676.0	61.6	36.6	72.5	55.5	33.2	4.020030	5.7389	167.9156
689.0	61.9	36.9	75.6	58.6	35.2	3.716593	7.9734	225.0313
702.0	62.1	37.1	75.3	58.3	35.0	5.002164	6.2500	262.1578
715.0	62.2	37.2	74.8	57.8	34.7	4.799504	5.4679	258.3033
728.0	62.4	37.4	75.9	58.9	35.4	5.254053	7.9406	216.1432
741.0	62.5	37.5	73.4	56.4	35.7	6.407714	6.3786	156.6643
754.0	62.8	37.8	73.4	56.4	37.6	5.462908	3.1994	116.5779
767.0	63.3	38.3	77.1	60.1	39.7	4.824739	2.1159	115.9443
780.0	63.9	38.9	81.2	64.2	42.1	4.374941	4.9717	155.9616
793.0	64.5	39.5	84.5	67.5	44.2	4.035131	7.6026	222.507
806.0	64.7	39.7	84.7	67.7	44.3	6.879632	6.8465	282.7521
819.0	64.6	39.6	81.5	64.5	42.3	7.599560	3.9819	311.7969
832.0	64.5	39.5	83.2	66.2	42.9	7.234957	6.8356	312.8568
845.0	64.1	39.1	83.7	66.7	43.2	8.800439	8.5462	274.7412
858.0	63.4	38.4	80.7	63.7	41.3	9.745729	6.7596	209.0848
871.0	62.6	37.6	76.6	59.6	38.9	8.141723	4.3574	150.7772
884.0	61.9	36.9	72.8	55.8	36.7	7.086907	2.7900	110.0557
897.0	61.3	36.3	69.5	52.5	34.9	6.348898	2.1484	82.76244
910.0	60.9	35.9	66.7	49.7	33.3	5.796478	2.4117	78.94103

923.0	60.5	35.5	67.2	50.2	32.0	5.362455	3.0756	96.26529
936.0	60.1	35.1	70.9	53.9	30.9	5.244270	2.3460	109.5862
949.0	59.8	34.8	72.1	55.1	31.8	5.472145	1.2112	103.4558
962.0	59.5	34.5	69.6	52.6	29.2	5.618825	2.4649	71.59902
975.0	59.1	34.1	65.5	48.5	27.9	5.338970	1.9451	38.09493
988.0	58.8	33.8	60.2	43.2	27.1	4.853728	1.0203	33.21771
1001	58.5	33.5	57.2	40.2	26.4	4.517613	0.5322	33.28189
1014	58.3	33.3	56.4	39.4	25.8	4.259025	0.6922	36.03094
1027	58.1	33.1	59.3	42.3	25.2	4.047267	1.2925	43.09115
1040	58.0	33.0	64.6	47.6	26.3	3.867201	2.2262	57.05089
1053	57.9	32.9	68.8	51.8	29.4	3.710255	2.7273	76.15647
1066	57.8	32.8	72.5	55.5	32.2	4.057522	1.3489	84.3326
1079	57.6	32.6	71.3	54.3	31.3	4.680930	1.9972	77.6205
1092	57.3	32.3	67.7	50.7	28.1	4.674845	2.6782	58.91633
1105	57.0	32.0	62.7	45.7	25.2	4.182894	1.8313	39.61395
1118	56.8	31.8	57.6	40.6	22.9	3.860002	1.0482	27.54152
1131	56.5	31.5	53.6	36.6	21.0	3.635636	0.6026	20.55602
1144	56.3	31.3	51.0	34.0	19.4	3.462820	0.3628	16.28169
1157	56.2	31.2	50.6	33.6	18.2	3.321116	0.2299	13.46816
1170	56.0	31.0	50.2	33.2	17.9	3.200227	0.1534	11.49392
1183	55.8	30.8	49.8	32.8	17.6	3.094311	0.1082	10.0351
1196	55.7	30.7	49.5	32.5	17.3	2.999756	0.0813	8.911962
1209	55.6	30.6	49.1	32.1	17.0	2.914171	0.0653	8.018515
1222	55.4	30.4	48.8	31.8	16.7	2.835886	0.0559	7.288886
1235	55.3	30.3	48.5	31.5	16.4	2.763691	0.0503	6.680248
1248	55.2	30.2	48.2	31.2	16.2	2.696669	0.0468	6.163611
1261	55.0	30.0	47.9	30.9	15.9	2.634115	0.0445	5.718705
1274	54.9	29.9	47.6	30.6	15.5	2.575467	0.0428	5.330911
1287	54.8	29.8	47.4	30.4	15.0	2.520271	0.0413	4.989446

Case #6 ROW EMF Cut @ Slatt Sub (Looking SW)

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Case #6 ROW EMF Cut @ Slatt Sub (Looking SW)_L2ABC-L1CBA
1-New DC 500 kV_4-Exist SC 500kV_2-Exist SC 230 kV
1,0,24,34,550.00,0.50,1.00,800.00
'COMB','XX','XX','XX','XX','XX','XX','XX'
5.000,6.5,10.000,0.000,1.000,60.000,3.281,2.000,3.281
'BN-SLC','A',430.00,35.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'BN-SLB','A',450.00,62.500,2,1.602,18.000,317.55,240.000,0.605,0.000
'BN-SLA','A',470.00,35.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'AS-MR2C','A',584.67,33.000,3,1.602,18.000,317.55,120.000,1.115,0.000
'AS-MR2B','A',600.00,51.667,3,1.602,18.000,317.55,240.000,1.115,0.000
'AS-MR2A','A',615.33,33.000,3,1.602,18.000,317.55,0.000,1.115,0.000
'AS-SL1C','A',694.67,33.000,3,1.602,18.000,317.55,120.000,1.995,0.000
'AS-SL1B','A',710.00,51.667,3,1.602,18.000,317.55,240.000,1.995,0.000
'AS-SL1A','A',725.33,33.000,3,1.602,18.000,317.55,0.000,1.995,0.000
'CS-SLC','A',800.00,33.000,2,1.602,18.000,317.55,120.000,1.921,0.000
'CS-SLB','A',820.00,61.500,2,1.602,18.000,317.55,240.000,1.921,0.000
'CS-SLA','A',840.00,33.000,2,1.602,18.000,317.55,0.000,1.921,0.000
'TR-ACB','A',931.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'TR-ACA','A',945.00,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'TR-ACC','A',958.17,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCB','A',1056.83,27.000,1,1.382,0.000,139.43,240.000,0.458,0.000
'MN-JCC','A',1070.00,27.000,1,1.382,0.000,139.43,120.000,0.458,0.000
'MN-JCA','A',1083.17,27.000,1,1.382,0.000,139.43,0.000,0.458,0.000
'CT-SL1C','A',320.00,95.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'CT-SL1B','A',325.00,65.000,2,1.602,18.000,317.55,240.000,0.605,0.000
'CT-SL1A','A',320.00,35.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'CT-SL2A','A',280.00,95.000,2,1.602,18.000,317.55,0.000,0.605,0.000
'CT-SL2B','A',275.00,65.000,2,1.602,18.000,317.55,240.000,0.605,0.000
'CT-SL2C','A',280.00,35.000,2,1.602,18.000,317.55,120.000,0.605,0.000
'BNSLSW1','A',437.08,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'BNDSLSW2','A',462.92,99.125,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW1','A',588.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-MRSW2','A',612.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW1','A',698.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'AS-SLSW2','A',722.00,91.167,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW1','A',808.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CS-SLSW2','A',832.00,104.750,1,0.385,0.000,0.00,0.000,0.000,0.000
'CTSLDSW1','A',290.00,137.500,1,0.465,0.000,0.00,0.000,0.000,0.000
'CTSLDSW2','A',310.00,137.500,1,0.465,0.000,0.00,0.000,0.000,0.000
100,0.0,13.0
0,0,0
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Data Output Report from CORONA Program

DIST FROM REF (ft)	AUDIBLE NOISE (RAIN) L50 DBA	AUDIBLE NOISE (FAIR) L50 DBA	RADIO INTERFER (RAIN) L50 DBµV/M	RADIO INTERFER (FAIR) L50 DBµV/M	TVI TOTAL RAIN DBµV/M	OZONE FOR RAIN RATE OF 1.00 mm/Hr @ 0.M Level PPB	ELECTRIC GRADIENT KV/M	MAGNETIC FIELD mGauss
0.0	59.2	34.2	58.6	41.6	22.7	0.000000	0.0527	2.865061
13.0	59.4	34.4	59.0	42.0	23.5	0.000000	0.0582	3.035482
26.0	59.6	34.6	59.5	42.5	24.4	0.000000	0.0645	3.227375
39.0	59.8	34.8	60.0	43.0	24.8	0.000000	0.0717	3.445266
52.0	60.0	35.0	60.6	43.6	25.3	0.000000	0.0801	3.694956
65.0	60.2	35.2	61.1	44.1	25.8	0.000000	0.0897	3.983987
78.0	60.4	35.4	61.8	44.8	26.3	0.000000	0.1009	4.322228

91.0	60.7	35.7	62.4	45.4	26.9	0.000000	0.1137	4.722749
104.0	60.9	35.9	63.1	46.1	27.5	0.000000	0.1284	5.203026
117.0	61.2	36.2	63.8	46.8	28.2	0.000000	0.1452	5.786653
130.0	61.5	36.5	64.6	47.6	28.9	0.000000	0.1644	6.505861
143.0	61.8	36.8	65.5	48.5	29.6	0.000000	0.1864	7.405157
156.0	62.1	37.1	66.4	49.4	30.5	0.000000	0.2119	8.546738
169.0	62.5	37.5	67.3	50.3	31.4	0.000000	0.2435	10.01876
182.0	62.9	37.9	68.3	51.3	32.4	0.000000	0.2885	11.94821
195.0	63.3	38.3	69.3	52.3	33.6	0.000000	0.3672	14.52136
208.0	63.8	38.8	70.4	53.4	34.9	0.000000	0.5270	18.01669
221.0	64.3	39.3	72.2	55.2	36.4	0.000000	0.8629	22.85478
234.0	64.8	39.8	74.3	57.3	38.1	0.000000	1.5479	29.65372
247.0	65.4	40.4	77.9	60.9	40.2	0.000000	2.8550	39.18534
260.0	66.1	41.1	81.7	64.7	42.4	0.000000	4.9383	51.74866
273.0	66.6	41.6	84.6	67.6	44.2	0.000000	6.8404	64.87796
286.0	66.9	41.9	84.7	67.7	44.3	3.863109	6.1245	72.09332
299.0	67.0	42.0	81.9	64.9	42.6	7.502990	3.6508	71.43912
312.0	67.1	42.1	84.8	67.8	44.5	6.771094	5.5821	66.66409
325.0	66.9	41.9	85.2	68.2	44.7	7.757917	6.6946	58.35004
338.0	66.5	41.5	82.6	65.6	43.1	11.864870	4.8541	48.92569
351.0	66.1	41.1	78.8	61.8	40.9	11.424670	2.4096	42.64046
364.0	65.7	40.7	75.2	58.2	38.8	9.949509	0.6300	40.45552
377.0	65.5	40.5	72.3	55.3	37.0	8.669445	1.0928	41.95807
390.0	65.4	40.4	74.0	57.0	37.1	7.658372	2.6042	47.12554
403.0	65.4	40.4	77.7	60.7	39.3	6.858418	4.5905	56.30656
416.0	65.6	40.6	81.3	64.3	41.5	6.214316	6.8339	68.7297
429.0	65.8	40.8	83.2	66.2	42.6	5.685797	7.5484	79.2456
442.0	65.8	40.8	81.8	64.8	41.7	8.942712	5.1174	81.30234
455.0	65.7	40.7	81.6	64.6	41.8	7.690096	4.2988	76.72291
468.0	65.5	40.5	83.6	66.6	43.1	8.298222	7.0379	68.41143
481.0	65.2	40.2	82.5	65.5	42.4	11.613850	6.9575	57.76126
494.0	64.6	39.6	79.1	62.1	40.3	9.984142	4.7464	49.93747
507.0	64.1	39.1	75.3	58.3	38.1	8.566140	2.5493	47.58034
520.0	63.7	38.7	71.9	54.9	36.1	7.585498	0.9113	50.21853
533.0	63.3	38.3	68.9	51.9	34.5	6.861742	0.8909	57.65988
546.0	63.1	38.1	66.4	49.4	33.0	6.298099	2.5584	70.87258
559.0	62.9	37.9	69.9	52.9	31.8	5.841863	4.9300	91.49926
572.0	62.9	37.9	73.8	56.8	33.8	5.461960	7.6120	118.5657
585.0	62.8	37.8	75.5	58.5	35.0	5.138764	7.9606	140.0013
598.0	62.8	37.8	73.6	56.6	33.7	6.515726	4.9296	139.3576
611.0	62.7	37.7	75.8	58.8	35.4	6.587684	6.9233	118.6044
624.0	62.6	37.6	75.2	58.2	34.9	8.061255	7.6765	90.55676
637.0	62.4	37.4	71.7	54.7	32.7	7.225079	4.9563	78.54612
650.0	62.3	37.3	67.6	50.6	30.4	6.386922	2.0195	90.32854
663.0	62.3	37.3	68.4	51.4	30.8	5.806627	2.6306	120.2967
676.0	62.4	37.4	72.5	55.5	33.2	5.373892	5.7478	168.2608
689.0	62.6	37.6	75.6	58.6	35.1	5.031699	7.9801	226.655
702.0	62.7	37.7	75.3	58.3	35.0	6.277640	6.2554	264.402
715.0	62.8	37.8	74.8	57.8	34.7	6.040911	5.4709	260.1581
728.0	62.9	37.9	75.9	58.9	35.4	6.467829	7.9419	216.7903
741.0	63.1	38.1	73.4	56.4	35.7	7.590228	6.3799	155.9066
754.0	63.3	38.3	73.4	56.4	37.5	6.616330	3.2020	114.942
767.0	63.7	38.7	77.1	60.1	39.7	5.950561	2.1228	114.7129
780.0	64.3	39.3	81.2	64.2	42.1	5.474565	4.9767	155.8425
793.0	64.8	39.8	84.5	67.5	44.2	5.109858	7.6066	223.2885
806.0	65.0	40.0	84.6	67.6	44.3	7.926517	6.8501	283.9895
819.0	64.9	39.9	81.5	64.5	42.3	8.622604	3.9860	312.9922
832.0	64.8	39.8	83.2	66.2	42.9	8.241741	6.8374	313.6633
845.0	64.4	39.4	83.7	66.7	43.2	9.788822	8.5476	274.9658
858.0	63.8	38.8	80.7	63.7	41.3	10.713140	6.7608	208.8083
871.0	63.0	38.0	76.6	59.6	38.9	9.090408	4.3577	150.2162

884.0	62.4	37.4	72.8	55.8	36.7	8.017474	2.7883	109.3639
897.0	61.8	36.8	69.5	52.5	34.9	7.262029	2.1435	82.02098
910.0	61.4	36.4	66.7	49.7	33.3	6.692857	2.4049	78.34679
923.0	61.0	36.0	67.2	50.2	31.9	6.242737	3.0695	95.60425
936.0	60.8	35.8	70.9	53.9	30.9	6.109895	2.3418	108.8897
949.0	60.5	35.5	72.1	55.1	31.7	6.322861	1.2157	102.8207
962.0	60.1	35.1	69.6	52.6	29.2	6.454004	2.4701	71.1836
975.0	59.8	34.8	65.5	48.5	27.9	6.159933	1.9507	37.4584
988.0	59.5	34.5	60.2	43.2	27.1	5.661634	1.0254	32.68167
1001	59.3	34.3	57.2	40.2	26.4	5.312777	0.5326	32.75917
1014	59.1	34.1	56.4	39.4	25.8	5.041821	0.6856	35.51387
1027	58.9	33.9	59.3	42.3	25.1	4.818085	1.2852	42.59018
1040	58.8	33.8	64.6	47.6	26.2	4.626416	2.2198	56.60313
1053	58.7	33.7	68.8	51.8	29.4	4.458232	2.7225	75.90396
1066	58.6	33.6	72.5	55.5	32.2	4.796195	1.3473	84.49883
1079	58.5	33.5	71.3	54.3	31.3	5.407148	2.0011	78.06997
1092	58.2	33.2	67.7	50.7	28.1	5.390441	2.6820	59.20247
1105	57.9	32.9	62.6	45.6	25.2	4.888834	1.8355	39.62263
1118	57.7	32.7	57.6	40.6	22.9	4.556455	1.0527	27.37367
1131	57.5	32.5	53.6	36.6	21.0	4.322810	0.6071	20.29621
1144	57.4	32.4	51.0	34.0	19.4	4.140951	0.3671	15.97636
1157	57.2	32.2	50.6	33.6	18.2	3.990444	0.2336	13.14148
1170	57.1	32.1	50.2	33.2	17.9	3.860988	0.1562	11.15868
1183	56.9	31.9	49.8	32.8	17.6	3.746734	0.1099	9.698267
1196	56.8	31.8	49.5	32.5	17.3	3.644062	0.0816	8.577446
1209	56.7	31.7	49.2	32.2	17.0	3.550572	0.0642	7.688547
1222	56.5	31.5	48.8	31.8	16.7	3.464590	0.0535	6.964751
1235	56.4	31.4	48.5	31.5	16.5	3.384893	0.0468	6.362653
1248	56.3	31.3	48.2	31.2	16.2	3.310562	0.0426	5.852933
1261	56.2	31.2	47.9	30.9	15.9	3.240880	0.0397	5.415103
1274	56.1	31.1	47.7	30.7	15.6	3.175280	0.0376	5.034419
1287	56.0	31.0	47.4	30.4	15.1	3.113301	0.0359	4.7

EXHIBIT BB

OTHER INFORMATION

OAR 345-021-0010(1)(bb)

Any other information that the Department requests in the project order or in a notification regarding expedited review.

Response: The information requested by the Department is addressed in other exhibits.

EXHIBIT CC

OTHER LAW

OAR 345-021-0010(1)(cc)

TABLE OF CONTENTS

CC.1 INTRODUCTION

OAR 345-021-0010(1)(cc) *Identification, by legal citation, of all state statutes and administrative rules and local government ordinances containing standards or criteria that the proposed facility must meet for the Council to issue a site certificate, other than statutes, rules and ordinances identified in Exhibit E, and identification of the agencies administering those statutes, administrative rules and ordinances. The applicant shall identify all statutes, administrative rules and ordinances that the applicant knows to be applicable to the proposed facility, whether or not identified in the project order. To the extent not addressed by other materials in the application, the applicant shall include a discussion of how the proposed facility meets the requirements of the applicable statutes, administrative rules and ordinances.*

CC.2 APPLICABLE STATUTES, RULES AND ORDINANCES

Response: The following state statutes and administrative rules, not listed in Exhibit E, contain standards or criteria that must be met in order for the Energy Facility Siting Council to issue a Site Certificate for the proposed Carty Generating Station. All applicable local ordinances related to permits required for the facility are listed in Exhibit E.

State Statutes/Administrative Rules	Administering Agency	Compliance Issue	Associated Exhibit
Noise			
ORS 467.020 and 467.030	Department of Environmental Quality	DEQ Noise Standard compliance	Exhibit X, Noise
OAR 340-035-0035			
Fish and Wildlife			
ORS 496	Department of Fish and Wildlife	Oregon Habitat Conservation Compliance	Exhibit P, Fish and Wildlife
OAR Chapter 635, Division 100		ODFW Habitat Mitigation Policy Compliance	
OAR Chapter 635, Division 415		Fish Screening Requirements	
Threatened & Endangered Plant Species			
ORS 564	Department of Agriculture	State and federal threatened and endangered species protection and compliance programs	Exhibit Q, Threatened and Endangered Species
OAR Chapter 603, Division 73			

State Statutes/Administrative Rules	Administering Agency	Compliance Issue	Associated Exhibit
Historic Preservation			
ORS 97.745	State Historic Preservation Office, State Parks and Recreation Department	Historic, Cultural or Archaeological Resources Site Assessment	Exhibit S, Historic, Cultural Resources
ORS 358		Recreational Opportunities Site Assessment	
ORS 390			
OAR Chapter 736, Division 51			
Land Use			
OAR 660-033-0090, Agricultural Lands	Department of Land Conservation and Development	Statewide Land Use Goals	Exhibit K, Land Use Standard
OAR 660-033-0100, Agricultural Lands			
OAR 660-033-0120, Agricultural Lands			
660-015-0000 (1), Statewide Land Use Goal 1, Citizen Involvement			
660-015-0000 (2), Statewide Land Use Goal 2, Land Uses			
660-015-0000 (3), Statewide Land Use Goal 3, Agricultural Lands			
660-15-0000 (5), Goal 5, Natural Resources, Scenic and Historic Areas and Open Spaces			
660-015-0000 (6), Statewide Land Use Goal 6, Air, Water and Land Resource Quality			
660-015-0000 (7), Statewide Land Use Goal 7, Areas Subject to Natural Hazards			
660-015-0000 (8), Statewide Land Use Goal 8, Recreational Needs			
660-015-0000 (9), Goal 9, Economic Development			
660-015-0000 (10), Statewide Land Use Goal 10, Housing			
660-015-0000 (11), Statewide Land Use Goal 11 Public Facilities and Services			
660-015-0000 (3), Statewide Land Use Goal 12, Transportation			
660-015-0000 (13), Statewide Land Use Goal 13, Energy Conservation			
660-015-0000 (14), Statewide Land Use Goal 14, Urbanization			
ORS 215.275, Utility Facilities Necessary for Public Service			

EXHIBIT DD

SPECIFIC STANDARDS

OAR 345-021-0010(1)(dd)

If the proposed facility is a facility for which the Council has adopted specific standards, information about the facility providing evidence to support findings by the Council.

Response: This exhibit is not applicable to the proposed Carty Generating Station.