10 - 7 FORECAST OF FINANCIAL STATEMENT FOR OLD LAKHRA POWER STATION

Forecast of Financial Statements for Old Lakhra Power Station

PL (Unit: Mil. Rs.)	2016 Year 0	2017 Year 1	2018 Year 2	2019 Year 3	2020 Year 4	2021 Year 5	2022 Year 6	2023 Year 7	2024 Year 8	2025 Year 9	2026 Year 10	2027 Year 11	2028 Year 12
Turnover	1,306	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568
Cost of sales (fuel, limestone & ash)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)
Gross profit	(92)	169	169	169	169	169	169	169	169	169	169	169	169
Varialbe O&M	-	-	-	-	-	-	-	-	-	-	-	-	-
Fixed O&M	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax & contingency during construction	-	-	-	-	-	-	-	-	-	-	-	-	-
Railway O&M (not passthrough)	-	-	-	-	-	-	-	-	-	-	-	-	-
Other operating expenditure	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)
Depreciattion	(263)	(263)	(263)	(263)	(263)	(263)	-	-	-	-	-	-	-
Operational profit	(568)	(306)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Non operating income (interest)	4	2	0	-	-	-	-	-	-	-	-	-	-
Non operating expenditure (others)	-	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expendiure (insurance)	-	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expenditure (working capital)	-	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expenditure (Loan interest)	(768)	-	-	-	-	-	-	-	-	-	-	-	-
Oridinary profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Extraordinary gain & loss	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit before tax	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Net profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Accumulated earnings at begining of year	(7,185)	(8,516)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	(10,174)	(10,217)	(10,260)	(10,303)
Net profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated earnings at end of year	(8,516)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	(10,174)	(10,217)	(10,260)	(10,303)	(10,346)

BS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Cash & equivalent	22	5	-	-	-	-	-	-	-	-	-	-	-
Receivables	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628
Stocks	245	245	245	245	245	245	245	245	245	245	245	245	245
Other current assets	16	16	16	16	16	16	16	16	16	16	16	16	16
Fixed asset (Building & Equipment)	1,337	1,066	803	540	277	14	14	14	14	14	14	14	14
Fixed asset (Land)	-	-	-	-	-	-	-	-	-	-	-	-	-
Other fixed assets	10	10	10	10	10	10	10	10	10	10	10	10	10
Other items	-	-	-	-	-	-	-	-	-	-	-	-	-
Total asset	10,258	9,970	9,701	9,438	9,175	8,912	8,912	8,912	8,912	8,912	8,912	8,912	8,912
Payable	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944
Current portion of long-term loan	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133
Other current liability	112	112	112	112	112	112	112	112	112	112	112	112	112
Debt	17	17	55	98	141	184	227	270	313	356	399	442	485
Other fixed liability	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
Capital	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034
Accumulated profit	(8,532)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	(10,174)	(10,217)	(10,260)	(10,303)	(10,346)
Liablilitеis & shareholder's equity	10,258	9,970	9,701	9,438	9,175	8,912	8,912	8,912	8,912	8,912	8,912	8,912	8,912

CF	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Balance at begginng of year	56	38	5	-	-	-	-	-	-	-	-	-	-
Operational CF: Net profit after tax	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Operational CF: Change in working capital	2,536	-	-	-	-	-	-	-	-	-	-	-	-
Operational CF: Depreciation	263	263	263	263	263	263	-	-	-	-	-	-	-
Operational CF: Others	(1,209)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Investment CF: Fixed asset (Building & Equipment)	(18)	9	-	-	-	-	-	-	-	-	-	-	-
Investment CF: Fixed asset (Land)		-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Debt principal	(259)	-	37	43	43	43	43	43	43	43	43	43	43
Balance at end of year	38	5	-	-	-	-	-	-	-	-	-	-	-

Assumptions

PL	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Interest rate for loan	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Interest rate for deposit	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Corporate tax	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
BS—Working capital													
Sales to receivable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sales to payable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
BS—Fixed assets													
Balance at beggining of year	1,592	1,329	1,066	803	540	277	14	14	14	14	14	14	14
Capital expenditure	-	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation	(263)	(263)	(263)	(263)	(263)	(263)	-	-	-	-	-	-	-
Balance at end of year	1,329	1,066	803	540	277	14	14	14	14	14	14	14	14
Annual percentage of depreciation	N.A.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	3.3%	3.3%	3.3%	3.3%

Indicators

Return on Equity (ROE)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.7%	0.7%	0.7%	0.7%	0.7%
Return on Asset (ROA)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%
Debt service coverage ratio (DSCR)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Current Ratio		67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%
Equity capital ratio		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-68.9%	-69.4%	-69.9%	-70.3%	-70.8%

Forecast of Financial Statements for Old Lakhra Power Station

(Unit: Mil. Rs.)	2029 Year 13	2030 Year 14	2031 Year 15	2032 Year 16	2033 Year 17	2034 Year 18	2035 Year 19	2036 Year 20
Turnover	1,568	1,568	1,568	1,568	1,568	1,568	1,568	1,568
Cost of sales (fuel, limestone & ash)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)
Gross profit	169	169	169	169	169	169	169	169
Varialbe O&M	-	-	-	-	-	-	-	-
Fixed O&M	-	-	-	-	-	-	-	-
Tax & contingency during construction	-	-	-	-	-	-	-	-
Railway O&M (not passthrough)	-	-	-	-	-	-	-	-
Other operating expenditure	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)
Depreciattion	-	-	-	-	-	-	-	-
Operational profit	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Non operating income (interest)	-	-	-	-	-	-	-	-
Non operating expenditure (others)	-	-	-	-	-	-	-	-
Non operating expendiure (insurance)	-	-	-	-	-	-	-	-
Non operating expenditure (working capital)	-	-	-	-	-	-	-	-
Non operating expenditure (Loan interest)	-	-	-	-	-	-	-	-
Oridinary profit	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Extraordinary gain & loss	-	-	-	-	-	-	-	-
Profit before tax	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Tax	-	-	-	-	-	-	-	-
Net profit	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Accumulated earnings at begining of year	(10,346)	(10,389)	(10,432)	(10,475)	(10,518)	(10,561)	(10,604)	(10,647)
Net profit	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Dividend	-	-	-	-	-	-	-	-
Accumulated earnings at end of year	(10,389)	(10,432)	(10,475)	(10,518)	(10,561)	(10,604)	(10,647)	(10,690)

	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Cash & equivalent	-	-	-	-	-	-	-	-
Receivables	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628
Stocks	245	245	245	245	245	245	245	245
Other current assets	16	16	16	16	16	16	16	16
Fixed asset (Building & Equipment)	14	14	14	14	14	14	14	14
Fixed asset (Land)	-	-	-	-	-	-	-	-
Other fixed assets	10	10	10	10	10	10	10	10
Other items	-	-	-	-	-	-	-	-
Total asset	8,912	8,912	8,912	8,912	8,912	8,912	8,912	8,912
Payable	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944
Current portion of long-term loan	6,133	6,133	6,133	6,133	6,133	6,133	6,133	6,133
Other current liability	112	112	112	112	112	112	112	112
Debt	528	571	614	657	700	744	787	830
Other fixed liability	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
Capital	4,034	4,034	4,034	4,034	4,034	4,034	4,034	4,034
Accumulated profit	(10,389)	(10,432)	(10,475)	(10,518)	(10,561)	(10,604)	(10,647)	(10,690)
Liabliliteis & shareholder's equity	8,912	8,912	8,912	8,912	8,912	8,912	8,912	8,912

	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Balance at begginng of year	-	-	-	-	-	-	-	-
Operational CF: Net profit after tax	(43)	(43)	(43)	(43)	(43)	(43)	(43)	(43)
Operational CF: Change in working capital	-	-	-	-	-	-	-	-
Operational CF: Depreciation	-	-	-	-	-	-	-	-
Operational CF: Others	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Investment CF: Fixed asset (Building & Equipment)	-	-	-	-	-	-	-	-
Investment CF: Fixed asset (Land)	-	-	-	-	-	-	-	-
Financial CF: Capital	-	-	-	-	-	-	-	-
Financial CF: Debt principal	43	43	43	43	43	43	43	43
Balance at end of year	-	-	-	-	-	-	-	-

ıptions

	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Interest rate for loan	15%	15%	15%	15%	15%	15%	15%	15%
Interest rate for deposit	7%	7%	7%	7%	7%	7%	7%	7%
Corporate tax	35%	35%	35%	35%	35%	35%	35%	35%

Working capital

Sales to receivable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sales to payable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Fixed assets

Balance at beggining of year	14	14	14	14	14	14	14	14
Capital expenditure	-	-	-	-	-	-	-	-
Depreciation	-	-	-	-	-	-	-	-
Balance at end of year	14	14	14	14	14	14	14	14
Annual percentage of depreciation	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%

ıtors

Return on Equity (ROE)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.6%
Return on Asset (ROA)	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%
Debt service coverage ratio (DSCR)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Current Ratio	67%	67%	67%	67%	67%	67%	67%	67%
Equity capital ratio	-71.3%	-71.8%	-72.3%	-72.8%	-73.2%	-73.7%	-74.2%	-74.7%

10 - 8 FORECAST OF CONSOLIDATED FINANCIAL STATEMENT FOR NEW AND OLD LAKHRA POWER STATION

Forecast of Consolidated Financial Statements for New and Old Lakhra Power Stations

Generation & Tariff	2016 Year 0	2017 Year 1	2018 Year 2	2019 Year 3	2020 Year 4	2021 Year 5	2022 Year 6	2023 Year 7	2024 Year 8	2025 Year 9	2026 Year 10	2027 Year 11	2028 Year 12
Gross Generation (GWh)	-	-	-	-	-	-	-	-	4,625	4,625	4,625	4,625	4,625
Net Generation (GWh)	-	-	-	-	-	-	-	-	4,255	4,255	4,255	4,255	4,255
Capacity charge (Mil. Rs.)	-	-	-	-	-	-	-	-	21,809	21,809	21,809	21,809	21,809
Energy charge (Mil. Rs)	-	-	-	-	-	-	-	-	22,556	22,556	22,556	22,556	22,556

PL (Unit: Mil. Rs.)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Turnover	1,306	1,568	1,568	1,568	1,568	1,568	1,568	1,568	48,975	48,844	48,460	48,076	47,693
Cost of sales (fuel, limestone & ash)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(1,398)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)
Gross profit	(92)	169	169	169	169	169	169	169	26,153	26,021	25,637	25,254	24,870
Varialbe O&M	-	-	-	-	-	-	-	-	(2,966)	(2,966)	(2,966)	(2,966)	(2,966)
Fixed O&M	-	-	-	-	-	-	-	-	(185)	(417)	(417)	(417)	(417)
	-	-	-	-	-	-	-	-	-	-	-	-	-
Railway O&M (Not passthrough)	-	-	-	-	-	-	-	-	(578)	(578)	(578)	(578)	(578)
Other operating expenditure	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)
Depreciattion	(263)	(263)	(263)	(263)	(263)	(263)	-	-	(5,525)	(5,857)	(5,857)	(5,857)	(5,857)
Operational profit	(568)	(306)	(306)	(306)	(306)	(306)	(43)	(43)	16,685	15,990	15,606	15,222	14,839
Non operating income (interest)	4	2	0	-	-	-	-	-	2,294	3,330	4,293	4,673	5,068
	-	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expendiure (insurance)	-	-	-	-	-	-	-	-	(440)	(440)	(440)	(440)	(440)
Non operating expenditure (working capital)	-	-	-	-	-	-	-	-	(985)	(985)	(985)	(985)	(985)
Non operating expenditure (Loan interest)	(768)	-	-	-	-	-	-	-	-	(4,090)	(10,521)	(10,166)	(9,810)
Oridinary profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	17,554	13,804	7,953	8,304	8,671
Extraordinary gain & loss	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit before tax	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	17,554	13,804	7,953	8,304	8,671
Tax	-	-	-	-	-	-	-	-	(6,159)	(4,847)	(2,799)	(2,922)	(3,050)
Net profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	11,395	8,958	5,155	5,383	5,621
Accumulated earnings at begining of year	(7,185)	(8,516)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	1,264	10,222	15,376	20,759
Net profit	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	11,395	8,958	5,155	5,383	5,621
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated earnings at end of year	(8,516)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	1,264	10,222	15,376	20,759	26,380

BS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Cash & equivalent	22	29,283	29,166	29,166	28,203	28,203	28,203	32,768	47,566	61,332	66,750	72,397	78,282
Receivables	8,628	8,628	8,628	8,628	8,628	8,628	8,628	8,628	12,579	12,568	12,536	12,504	12,472
Stocks	245	245	245	245	245	245	245	245	245	245	245	245	245
Other current assets	16	16	16	16	16	16	16	16	16	16	16	16	16
Fixed asset (Building & Equipment)	1,337	1,066	1,584	14,626	16,739	58,146	138,153	166,439	170,905	165,048	159,191	153,334	147,477
Fixed asset (Land)	-	-	111	111	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074
Other fixed assets	10	10	10	10	10	10	10	10	10	10	10	10	10
Other items	-	-	-	-	-	-	-	-	-	-	-	-	-
Total asset	10,258	39,247	39,760	52,802	54,916	96,322	176,330	209,180	232,395	240,293	239,822	239,580	239,576
Payable	6,944	6,944	6,944	6,944	6,944	6,944	6,944	6,944	8,729	8,729	8,729	8,729	8,729
Current portion of long-term loan	6,133	6,133	6,133	6,133	6,133	6,133	6,133	10,697	10,697	10,697	10,697	10,697	10,697
Other current liability	112	112	112	112	112	112	112	112	112	112	112	112	112
Debt	17	17	836	14,184	16,604	58,316	138,367	166,695	176,730	175,670	170,045	164,420	158,795
Other fixed liability	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
Capital	4,034	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311
Accumulated profit	(8,532)	(8,821)	(9,126)	(9,433)	(9,739)	(10,045)	(10,088)	(10,131)	1,264	10,222	15,376	20,759	26,380
Liablilitеis & shareholder's equity	10,258	39,247	39,760	52,802	54,915	96,322	176,330	209,180	232,395	240,292	239,822	239,580	239,576

CF	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Balance at begginng of year	56	29,316	29,283	29,166	29,166	28,203	28,203	28,203	32,768	47,566	61,332	66,750	72,397
Operational CF: Net profit after tax	(1,331)	(304)	(306)	(306)	(306)	(306)	(43)	(43)	11,395	8,958	5,155	5,383	5,621
Operational CF: Change in working capital	2,536	-	-	-	-	-	-	-	(2,165)	11	32	32	32
Operational CF: Depreciation	263	263	263	263	263	263	-	-	5,525	5,857	5,857	5,857	5,857
Operational CF: Others	(1,209)	(0)	(0)	(0)	(0)	(0)	(0)	4,565	(0)	(0)	(0)	(0)	(0)
Investment CF: Fixed asset (Building & Equipment)	(18)	9	(781)	(13,305)	(2,377)	(41,669)	(80,008)	(28,285)	(9,992)	(0)	(0)	(0)	(0)
Investment CF: Fixed asset (Land)	-	-	(111)	-	(963)	-	-	-	-	-	-	-	-
Financial CF: Capital	29,278	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Debt principal	(259)	-	819	13,348	2,420	41,712	80,051	28,328	10,035	(1,060)	(5,625)	(5,625)	(5,625)
Balance at end of year	29,316	29,283	29,166	29,166	28,203	28,203	28,203	32,768	47,566	61,332	66,750	72,397	78,282

Assumptions

PL	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Interest rate for loan	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Interest rate for deposit	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Corporate tax	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%

BS—Working capital													
Sales to receivable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sales to payable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

BS—Fixed assets													
Balance at beggining of year	1,592	1,329	1,066	1,584	14,626	16,739	58,146	138,153	166,439	170,905	165,048	159,191	153,334
Capital expenditure	-	-	781	13,305	2,377	41,669	80,008	28,285	9,992	-	-	-	-
Depreciation	(263)	(263)	(263)	(263)	(263)	(263)	-	-	(5,525)	(5,857)	(5,857)	(5,857)	(5,857)
Balance at end of year	1,329	1,066	1,584	14,626	16,739	58,146	138,153	166,439	170,905	165,048	159,191	153,334	147,477
Annual percentage of depreciation	N.A.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	3.3%	3.3%	3.3%	3.3%

Indicators													
Return on Equity (ROE)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	33.0%	20.6%	10.6%	10.0%	9.4%
Return on Asset (ROA)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	4.9%	3.7%	2.1%	2.2%	2.3%
Debt service coverage ratio (DSCR)		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0	3.7	1.3	1.4	1.4
Current ratio		289%	289%	289%	281%	281%	281%	235%	309%	380%	407%	436%	466%
Equity capital ratio		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	14.9%	18.1%	20.3%	22.6%	24.9%

Forecast of Consolidated Financial Statements for New and Old Lakhra Power Stations

ration & Tariff	2029 Year 13	2030 Year 14	2031 Year 15	2032 Year 16	2033 Year 17	2034 Year 18	2035 Year 19	2036 Year 20	2037 Year 21	2038 Year 22	2039 Year 23	2040 Year 24
Gross Generation (GWh)	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625
Net Generation (GWh)	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255
Capacity charge (Mil. Rs.)	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809
Energy charge (Mil. Rs)	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556

(Unit: Mil. Rs.)	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
Turnover	47,309	46,925	46,542	46,158	45,774	45,396	45,013	44,629	44,245	43,862	43,478	43,094
Cost of sales (fuel, limestone & ash)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)
Gross profit	24,486	24,103	23,719	23,335	22,952	22,574	22,190	21,806	21,423	21,039	20,655	20,272
Varialbe O&M	(2,966)	(2,966)	(2,966)	(2,966)	(2,966)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)
Fixed O&M	(417)	(417)	(417)	(417)	(417)	(418)	(418)	(418)	(418)	(418)	(418)	(418)
	-	-	-	-	-	-	-	-	-	-	-	-
Railway O&M (Not passthrough)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)
Other operating expenditure	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)
Depreciattion	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)
Operational profit	14,455	14,071	13,688	13,304	12,920	12,710	12,326	11,942	11,559	11,175	10,791	10,408
Non operating income (interest)	5,480	5,909	6,357	6,824	7,310	7,818	8,355	8,915	9,500	10,105	10,737	11,396
	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expendiure (insurance)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)
Non operating expenditure (working capital)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)
Non operating expenditure (Loan interest)	(9,455)	(9,100)	(8,745)	(8,389)	(8,034)	(7,679)	(7,324)	(6,968)	(6,613)	(6,258)	(5,903)	(5,547)
Oridinary profit	9,055	9,456	9,875	10,313	10,771	11,423	11,932	12,464	13,020	13,597	14,201	14,831
Extraordinary gain & loss	-	-	-	-	-	-	-	-	-	-	-	-
Profit before tax	9,055	9,456	9,875	10,313	10,771	11,423	11,932	12,464	13,020	13,597	14,201	14,831
Tax	(3,184)	(3,325)	(3,471)	(3,625)	(3,785)	(4,013)	(4,191)	(4,378)	(4,572)	(4,776)	(4,988)	(5,211)
Net profit	5,870	6,131	6,404	6,688	6,986	7,410	7,741	8,087	8,448	8,822	9,212	9,620
Accumulated earnings at begining of year	26,380	32,251	38,382	44,785	51,474	58,460	65,870	73,611	81,698	90,146	98,967	108,179
Net profit	5,870	6,131	6,404	6,688	6,986	7,410	7,741	8,087	8,448	8,822	9,212	9,620
Dividend	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated earnings at end of year	32,251	38,382	44,785	51,474	58,460	65,870	73,611	81,698	90,146	98,967	108,179	117,799

	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
Cash & equivalent	84,417	90,812	97,479	104,432	111,682	119,356	127,361	135,712	144,381	153,423	162,857	172,698
Receivables	12,440	12,408	12,376	12,344	12,312	12,281	12,249	12,217	12,185	12,153	12,121	12,089
Stocks	245	245	245	245	245	245	245	245	245	245	245	245
Other current assets	16	16	16	16	16	16	16	16	16	16	16	16
Fixed asset (Building & Equipment)	141,620	135,763	129,906	124,049	118,192	112,335	106,478	100,621	94,764	88,907	83,050	77,193
Fixed asset (Land)	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074
Other fixed assets	10	10	10	10	10	10	10	10	10	10	10	10
Other items	-	-	-	-	-	-	-	-	-	-	-	-
Total asset	239,821	240,328	241,106	242,170	243,531	245,316	247,432	249,894	252,674	255,828	259,372	263,324
Payable	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729
Current portion of long-term loan	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697
Other current liability	112	112	112	112	112	112	112	112	112	112	112	112
Debt	153,170	147,545	141,920	136,295	130,670	125,045	119,420	113,795	108,127	102,459	96,791	91,123
Other fixed liability	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
Capital	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311
Accumulated profit	32,251	38,382	44,785	51,474	58,460	65,870	73,611	81,698	90,146	98,967	108,179	117,799
Liablilitеis & shareholder's equity	239,821	240,327	241,106	242,170	243,531	245,316	247,432	249,894	252,674	255,827	259,372	263,324

	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
Balance at begginng of year	78,282	84,417	90,812	97,479	104,432	111,682	119,356	127,361	135,712	144,381	153,423	162,857
Operational CF: Net profit after tax	5,870	6,131	6,404	6,688	6,986	7,410	7,741	8,087	8,448	8,822	9,212	9,620
Operational CF: Change in working capital	32	32	32	32	32	32	32	32	32	32	32	32
Operational CF: Depreciation	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857
Operational CF: Others	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Investment CF: Fixed asset (Building & Equipment)	(0)	(0)	-	-	-	-	-	-	-	-	-	-
Investment CF: Fixed asset (Land)	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Capital	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Debt principal	(5,625)	(5,625)	(5,625)	(5,625)	(5,625)	(5,625)	(5,625)	(5,625)	(5,668)	(5,668)	(5,668)	(5,668)
Balance at end of year	84,417	90,812	97,479	104,432	111,682	119,356	127,361	135,712	144,381	153,423	162,857	172,698

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	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
Interest rate for loan	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Interest rate for deposit	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Corporate tax	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%

Working capital

Sales to receivable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sales to payable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Fixed assets

Balance at beggining of year	147,477	141,620	135,763	129,906	124,049	118,192	112,335	106,478	100,621	94,764	88,907	83,050
Capital expenditure	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)
Balance at end of year	141,620	135,763	129,906	124,049	118,192	112,335	106,478	100,621	94,764	88,907	83,050	77,193
Annual percentage of depreciation	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%

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Return on Equity (ROE)	9.0%	8.6%	8.2%	7.9%	7.6%	7.5%	7.2%	7.0%	6.8%	6.7%	6.5%	6.4%
Return on Asset (ROA)	2.4%	2.6%	2.7%	2.8%	2.9%	3.0%	3.1%	3.2%	3.3%	3.4%	3.6%	3.7%
Debt service coverage ratio (DSCR)	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9
Current ratio	497%	530%	564%	599%	636%	675%	716%	758%	803%	849%	897%	947%
Equity capital ratio	27.3%	29.8%	32.4%	35.0%	37.7%	40.4%	43.2%	46.0%	48.9%	51.7%	54.6%	57.4%

Forecast of Consolidated Financial Statements for New and Old Lakhra Power Stations

ration & Tariff	2041 Year 25	2042 Year 26	2043 Year 27	2044 Year 28	2045 Year 29	2046 Year 30	2047 Year 31	2048 Year 32	2049 Year 33	2050 Year 34	2051 Year 35	2052 Year 36	2053 Year 37
Gross Generation (GWh)	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625	4,625
Net Generation (GWh)	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255	4,255
Capacity charge (Mil. Rs.)	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809	21,809
Energy charge (Mil. Rs)	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556	22,556

(Unit: Mil. Rs.)	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
Turnover	42,711	42,327	41,943	41,560	41,176	40,792	40,409	40,025	39,641	39,258	38,874	38,490	38,107
Cost of sales (fuel, limestone & ash)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)	(22,822)
Gross profit	19,888	19,504	19,121	18,737	18,353	17,970	17,586	17,202	16,819	16,435	16,051	15,668	15,284
Varialbe O&M	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)	(2,798)
Fixed O&M	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)	(418)
	-	-	-	-	-	-	-	-	-	-	-	-	-
Railway O&M (Not passthrough)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)	(578)
Other operating expenditure	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)	(213)
Depreciattion	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)
Operational profit	10,024	9,640	9,257	8,873	8,489	8,106	7,722	7,338	6,955	6,571	6,187	5,804	5,420
Non operating income (interest)	12,083	12,800	13,547	14,328	15,142	15,991	16,877	17,801	18,766	19,773	20,823	21,919	23,063
	-	-	-	-	-	-	-	-	-	-	-	-	-
Non operating expendiure (insurance)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)	(440)
Non operating expenditure (working capital)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)	(985)
Non operating expenditure (Loan interest)	(5,192)	(4,837)	(4,482)	(4,127)	(3,771)	(3,416)	(3,061)	(2,706)	(2,350)	(1,995)	(1,640)	(1,285)	(929)
Oridinary profit	15,490	16,178	16,897	17,649	18,435	19,255	20,113	21,009	21,945	22,924	23,946	25,013	26,129
Extraordinary gain & loss	-	-	-	-	-	-	-	-	-	-	-	-	-
Profit before tax	15,490	16,178	16,897	17,649	18,435	19,255	20,113	21,009	21,945	22,924	23,946	25,013	26,129
Tax	(5,443)	(5,687)	(5,941)	(6,207)	(6,484)	(6,775)	(7,079)	(7,396)	(7,728)	(8,075)	(8,438)	(8,818)	(9,214)
Net profit	10,046	10,491	10,957	11,443	11,950	12,480	13,034	13,613	14,217	14,848	15,507	16,196	16,914
Accumulated earnings at begining of year	117,799	127,846	138,337	149,294	160,736	172,686	185,167	198,201	211,814	226,031	240,880	256,387	272,583
Net profit	10,046	10,491	10,957	11,443	11,950	12,480	13,034	13,613	14,217	14,848	15,507	16,196	16,914
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated earnings at end of year	127,846	138,337	149,294	160,736	172,686	185,167	198,201	211,814	226,031	240,880	256,387	272,583	289,497

	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
Cash & equivalent	182,965	193,677	204,855	216,518	228,689	241,391	254,646	268,480	282,918	297,988	313,716	330,133	342,703
Receivables	12,057	12,025	11,993	11,961	11,929	11,897	11,865	11,833	11,801	11,769	11,737	11,705	11,673
Stocks	245	245	245	245	245	245	245	245	245	245	245	245	245
Other current assets	16	16	16	16	16	16	16	16	16	16	16	16	16
Fixed asset (Building & Equipment)	71,335	65,478	59,621	53,764	47,907	42,050	36,193	30,336	24,479	18,622	12,765	6,908	1,051
Fixed asset (Land)	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074
Other fixed assets	10	10	10	10	10	10	10	10	10	10	10	10	10
Other items	-	-	-	-	-	-	-	-	-	-	-	-	-
Total asset	267,702	272,525	277,814	283,588	289,870	296,683	304,049	311,994	320,543	329,724	339,563	350,091	356,772
Payable	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729	8,729
Current portion of long-term loan	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	10,697	6,133
Other current liability	112	112	112	112	112	112	112	112	112	112	112	112	112
Debt	85,455	79,787	74,119	68,451	62,783	57,115	51,447	45,779	40,111	34,443	28,775	23,107	17,439
Other fixed liability	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551	1,551
Capital	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311	33,311
Accumulated profit	127,846	138,337	149,294	160,736	172,686	185,167	198,201	211,814	226,031	240,880	256,387	272,583	289,497
Liabliliteis & shareholder's equity	267,702	272,525	277,814	283,588	289,870	296,683	304,049	311,994	320,543	329,724	339,563	350,091	356,772

	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
Balance at begginng of year	172,698	182,965	193,677	204,855	216,518	228,689	241,391	254,646	268,480	282,918	297,988	313,716	330,133
Operational CF: Net profit after tax	10,046	10,491	10,957	11,443	11,950	12,480	13,034	13,613	14,217	14,848	15,507	16,196	16,914
Operational CF: Change in working capital	32	32	32	32	32	32	32	32	32	32	32	32	32
Operational CF: Depreciation	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857	5,857
Operational CF: Others	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(4,565)
Investment CF: Fixed asset (Building & Equipment)	-	-	-	-	-	-	-	-	-	-	-	-	-
Investment CF: Fixed asset (Land)	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
Financial CF: Debt principal	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)	(5,668)
Balance at end of year	182,965	193,677	204,855	216,518	228,689	241,391	254,646	268,480	282,918	297,988	313,716	330,133	342,703

mptions

	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
Interest rate for loan	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Interest rate for deposit	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
Corporate tax	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%

Working capital

Sales to receivable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sales to payable (Months)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Fixed assets

Balance at beggining of year	77,193	71,335	65,478	59,621	53,764	47,907	42,050	36,193	30,336	24,479	18,622	12,765	6,908
Capital expenditure	-	-	-	-	-	-	-	-	-	-	-	-	-
Depreciation	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)	(5,857)
Balance at end of year	71,335	65,478	59,621	53,764	47,907	42,050	36,193	30,336	24,479	18,622	12,765	6,908	1,051
Annual percentage of depreciation	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%	3.3%

tors

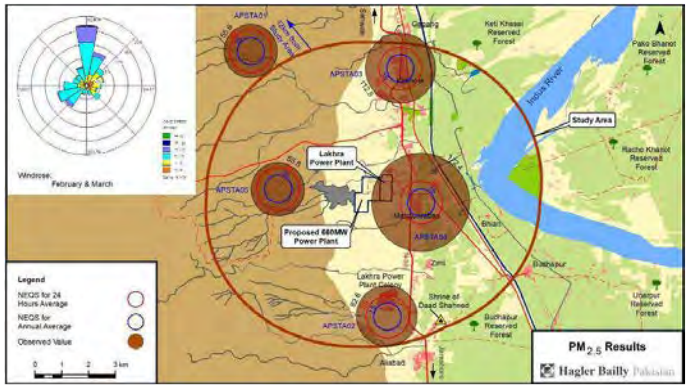
Return on Equity (ROE)	6.2%	6.1%	6.0%	5.9%	5.8%	5.7%	5.6%	5.6%	5.5%	5.4%	5.4%	5.3%	5.2%
Return on Asset (ROA)	3.8%	3.8%	3.9%	4.0%	4.1%	4.2%	4.3%	4.4%	4.4%	4.5%	4.6%	4.6%	4.7%
Debt service coverage ratio (DSCR)	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.8	3.0	3.1	3.4	3.6
Current ratio	999%	1054%	1111%	1171%	1233%	1298%	1365%	1436%	1510%	1587%	1667%	1751%	2368%
Equity capital ratio	60.2%	63.0%	65.7%	68.4%	71.1%	73.6%	76.1%	78.6%	80.9%	83.2%	85.3%	87.4%	90.5%

11 - 1 ENVIRONMENTAL CHECKLIST FOR POWER PLANT

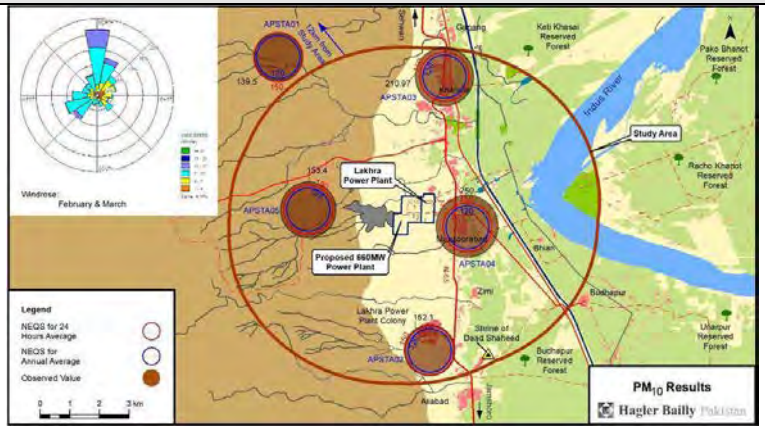
Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation			
(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	(a)Y	**Evaluation: EIA report has been completed.** (a) The EIA report has been completed as per guidelines of the JICA.
	(b) Have EIA reports been approved by authorities of the host country' government?	(b)N	(b) Not yet.
	(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	(c)N	(c) Not yet.
	(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(d)N	(d) Not yet. ・ Land for intake facility: Approval required from Sindh Revenue Department. The approval must be obtained prior to occupying the site. ・ Water from Indus River. Approval required from Irrigation Department to construct Intake Facility in Indus River. The Irrigation Department will also allocate water for the plant.
(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	(a)Y	**Evaluation: Contents of the project and the potential impacts were adequately explained to the local stakeholders.** (a) Explanations to local stakeholders were conducted between February and August in 2014.
	(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(b)Y	**Evaluation: Comments from the stakeholders have been reflected to the project design.** (b) The comments obtained from stakeholder meetings have been reflected to the project design.
(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)Y	**Evaluation: Alternatives of site selection were examined with social and environmental considerations.** (a) Three locations for the power plant and two locations for the ash pond were selected as alternatives and have been considered from environmental, social, technical and economic aspects.
2 Pollution Control			

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by the power plant operations comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause areas that do not comply with the country's ambient air quality standards? Are any mitigating measures taken?	Y	**Evaluation: According to the ambient air quality baseline study, PM_{10} and $PM_{2.5}$ have already exceeded the SEQS at most of the sampling points probably due to anthropogenic sources, natural circumstances and the existing Lakhra Plant. However air pollutants from the Project are negligible compared with those from the Lakhra Plant. JST has suggested GENCO to implement mitigation measures such as rehabilitation to the Lakhra Plant in order to meet SEQS.** [Impact by the Project] As per the air quality modeling results, predicted ambient air quality after proposed plant commissioning and LFPS rehabilitation meets the designated values (PM_{10} and $PM_{2.5}$) in SEQS. [Baseline of PM_{10} and $PM_{2.5}$] - As shown in the Figure 1 ($PM_{2.5}$) and Figure 2(PM_{10}), the ambient air quality baseline result indicates the current air quality has already exceeded the SEQS and IFC guidelines at most of the sampling sites. - The possible reasons of the excess are 1) existing Lakhra Plant, 2) local traffic on unsealed roads, 3) cooking in the houses using biomass fuel, and 4) desert and dry conditions. - In case the excesses are due to the Lakhra Plant, some mitigation measures shall be taken to the plant in order to reduce the PM_{10} and $PM_{2.5}$.  Source: Hagler Bailly Pakistan Figure 1 $PM_{2.5}$ Ambient Air Quality Baseline Result

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
			 Source: Hagler Bailly Pakistan Figure 2 PM_{10} Ambient Air Quality Baseline Result - JST has suggested GENCO to take action to reduce PM_{10} and $PM_{2.5}$. Among the following options, JST selected the third one taking into account financial, technical and environmental aspects. 1) to shut down the plant (0 MW); 2) to install ESP on the existing boiler (30 MW); or 3) to restore or rehabilitate the plant up to original design (150 MW)
	(b) In the case of coal-fired power plants, is there a possibility that fugitive dust from the coal piles, coal handling facilities, and dust from the coal ash disposal sites will cause air pollution? Are adequate measures taken to prevent the air pollution?	Y	**Evaluation: As water sprinkling is conducted regularly at the coal piles and ash disposal sites to prevent the air pollution from those sites.**

Environmental Checklist for Power Plant

<table>
<tr><th>Environmental Item</th><th>Main Check Items</th><th>Yes: Y
No: N</th><th>Confirmation of Environmental Considerations
(Reasons, Mitigation Measures)</th></tr>
<tr><td rowspan="3">(2) Water Quality</td><td>(a) Do effluents including thermal effluents from the power plant comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards or cause any significant temperature rise in the receiving waters?</td><td>Y</td><td>Evaluation: As no thermal discharge is generated, increase of river water temperature is not expected. Effluent from the Project is appropriately treated to meet the national standards at the effluent treatment facility.</td></tr>
<tr><td>(b) In the case of coal-fired power plants, do leachates from the coal piles and coal ash disposal sites comply with the country's effluent standards?</td><td>Y</td><td>Evaluation: Leachates are treated to meet the NEQS for effluents.

[Leachates flow]
Storm water from coal piles and coal ash disposal sites are drained into the coagulator with specific ditches. Then the surface water is treated at the effluent treatment facility and the sludge is collected and returned to the ash pond.</td></tr>
<tr><td>(c) Are adequate measures taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents?</td><td>Y</td><td>Evaluation: As adequate measures are taken, no significant impact on surface water, soil and groundwater is expected.

[Measures]
- During construction at the river, construction method which brings about less impact on the water quality is adopted.
- All effluents from the project are treated at the effluent treatment facility before discharging into the river.
- Storm water is drained into specific ditches which prevent the water from going outside of the boundary.
- Chemicals and oils are kept in the specific storages in order to prevent contamination of soil and groundwater.</td></tr>
<tr><td>(3) Wastes</td><td>(a) Are wastes, (such as waste oils, and waste chemical agents), coal ash, and by-product gypsum from flue gas desulfurization generated by the power plant operations properly treated and disposed of in accordance with the country's regulations?</td><td>Y</td><td>Evaluation: As the wastes are appropriately collected by licensed company and dumped safely in accordance with The Sindh Environmental Protection Act, 2014, no significant impact is expected.

[Type of Waste]
- During construction, municipal waste and hazardous waste are generated from base camps and construction sites, which should be appropriately treated by contractors.
- The type of wastes generated during operation is given in Table 1.

Table 1 Type of Waste during Operation
<table><tr><th>Type</th><th>Source</th><th>Quantity</th></tr><tr><td colspan="3">Industrial Waste</td></tr><tr><td>(1) Fly ash</td><td>ESP, scrubber system</td><td>549,806 ton/day</td></tr><tr><td>(2) Bottom ash</td><td>Boiler</td><td>61,090 ton/day</td></tr><tr><td>(3) Gypsum</td><td>FGD</td><td>96,096 ton/day</td></tr><tr><td colspan="3">Municipal Waste</td></tr></table></td></tr>
</table>

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)

(4)	Sludge	- Waste water treatment facility - Septic tanks	N/A
(5)	Plastic, garbage, paper, green waste, melal, glass etc.	Admin. Builing, power plant	N/A, little quantity
Hazardous Waste			
(6)	lubricant, turbine oil, HSD oil, hydraulic oil, etc.	Power plant, work shop	N/A, little quantity

Source: JICA Survey Team

[Segregation]

- (1) would be purchased by cement companies for recycling as cement material.
- Of (5), recyclable paper, plastics, glasses and metals should be segregated and recycled by recycling company, if possible.

[Disposal Methods]

- Disposal method during operation is given in Table 2.
- Agreement with licensed company should be reviewed every year and open tender is called for competitive bid.

Table 2 Disposal Method

Category	Type	Disposal methods
Industrial waste	Fly ash	Collected and sold to cement company. They utilize them as a cement material. Otherwise, disposed of at the ash pond.
	Gypsum	Gypsum can be utilized as a gypsum board material. However, there is no company with such technology in Pakistan so far. In future, this recycling method can be adopted.
Municipal waste	Sludge	Sludge from waste water treatment facility and septic tanks will be collected by licensed company and dumped safely.
	Plastic, paper, glasses	Junk shoppers will collect them and sell to the market.
Hazardous waste	Oil	Collected by licensed company and treated safely

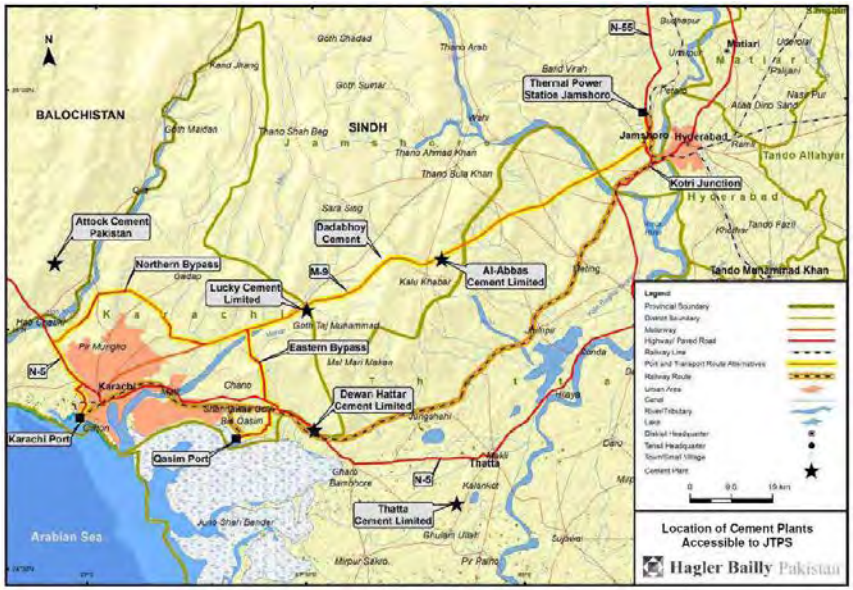
Source: JICA Survey Team

[Cement Application to Cement Material]

- Pakistan Standards and Quality Control Authority ('SQCA'), on the initiative of cement manufacturers have modified the Portland cement standards in 2008 to allow for up to 5% blending of fly ash in the manufacturing of cement.
- There are a number of potential users of ash produced by the project in the vicinity of the plant. The location of cement factories are as below map.

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
			- One of the manufactures, Power Cement Limited (formerly Al-Abbas Cement Limited) located about 90 km from Lakhra Plant has indicated that their plant can accept the ash about 50,000 ton per year till 2017 and 150,000 ton per year from 2017. (Hearing survey at Power Cement during 3rd Site Work)



Source: Jamshoro Final EIA

Figure 3 Location of Cement Plants

Environmental Checklist for Power Plant

<table>
<tr><th>Environmental Item</th><th>Main Check Items</th><th>Yes: Y
No: N</th><th>Confirmation of Environmental Considerations
(Reasons, Mitigation Measures)</th></tr>
<tr><td>(4) Noise and Vibration</td><td>(a) Do noise and vibrations comply with the country's standards?</td><td>Y</td><td>Evaluation: As insulation measures are conducted, no significant impact is expected.

[Noise source]
Main noise sources, each noise level and insulation measures are shown in Table 3. The project adopts the most appropriate devices for insulation measures taking into account the installation location and distance to the nearest affected residence/primary school.

Table 3 Noise Sources and its Level
<table>
<tr><th>Noise source</th><th>Noise level</th><th>Insulation measure and the effect</th></tr>
<tr><td>Boiler</td><td>- Bottom of boiler: 85 dB(A)
- Upside of boiler: 75 - 80 dB(A)</td><td>- Building enclosure: 25 dB (A)
- Insulation wall: 5 - 10 dB(A)
- Insulation lagging: N/A</td></tr>
<tr><td>Turbine building</td><td>- 65 - 70 dB(A)</td><td>- Insulation wall: 30 dB(A)</td></tr>
<tr><td>Transformer</td><td>- 80 - 85 dB(A)</td><td>- Insulation wall: 5 - 10 dB(A)
- Steel sheet insulation tank: 10 - 20 dB(A)
- Concrete panel insulation tank: 20 - 30 dB(A)
- Concrete insulation building: 30 - 40 dB(A)</td></tr>
<tr><td>Pump</td><td>- 60 - 70 dB(A)
(noise controlled level)</td><td>- Insulation lagging, suction port silencer</td></tr>
<tr><td>Belt conveyor</td><td>- 75 - 85 dB(A)</td><td>- Insulation cover, small noise roler, vibration control device: N/A</td></tr>
</table>
Source: Environmental Conservation Technology and Equipment (Thermal and Nuclear Power Engineering Society)

[NEQS for Noise]
The project adopts equipments and the insulation measure to meet the NEQS nighttime noise level (45 dB(A)).

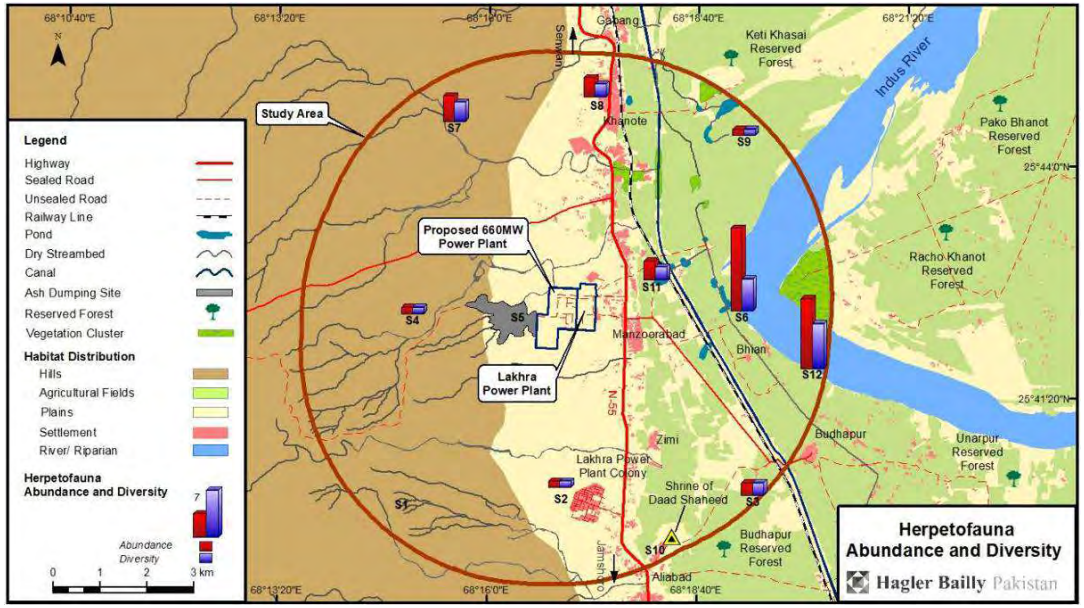
Table 4 NEQS for Noise
<table>
<tr><th>Category</th><th>Daytime (06:00 - 22:00)</th><th>Nighttime (22:00 - 06:00)</th></tr>
<tr><td>Residential area</td><td>55 dB(A)</td><td>45 dB(A)</td></tr>
</table></td></tr>
<tr><td>(5) Subsidence</td><td>(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?</td><td>N</td><td>Evaluation: As groundwater is not used in the project, subsidence does not occur.</td></tr>
<tr><td>(6) Odor</td><td>(a) Are there any odor sources? Are adequate odor control measures taken?</td><td>Y</td><td>Evaluation: Appropriate control measures are taken to avoid odor to generate.
As to kitchen waste, appropriate waste storage facilities are designed and constructed at the power plant, and licensed company collects them regularly. Septic tanks are maintained in good condition by regular management with chlorine. During operation phase,</td></tr>
</table>

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
			water is sprinkled on the coal and ash for avoiding spontaneous ignition. Consequently, no significant impact due to their odor would be expected.
3 Natural Environment			
(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	N	**Evaluation: Proposed site is not located in any protected area. Though there are three reserved forests, i.e., Keti Khasai, Budhapur, and Racho Khanot Reserved Forests, those forests are situated in more than 5 km from the proposed site. Therefore no significant impact would be expected.** - A reserved forest is a one where the species are protected in their natural habitat and no human interference is allowed or any kind of human activity is strictly prohibited without any special permission. (Stakeholder meeting at Forest Department, Hyderabad, during 3rd Site Work)  Keti Khasai Reserved Forest  Budhapur Reserved Forest
(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	N	**Evaluation: The project site encompasses no primeval forests, tropical rain forests, ecologically vulnerable habitats.**
	(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	**Evaluation: The project site encompasses no protected habitats of endangered species designated by the country's laws or international treaties and conventions.**
	(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on	N	**Evaluation: No significant ecological impact is predicted.**

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	the ecosystem?		- The project site for the power plant is situated inside of the existing Lakhra Plant estate. Though ash pond land (70 acre) needs to be acquired and land leveled, there is no precious species on the land. - To avoid fish suction by intaking water from the river, intake screen is applied at the intake facility. - Regarding reptiles, especially turtles, their nests are taken care of during their hibernation period. If necessary, EPC Contractor gets professional advice from ecological experts.



Source: Hagler Bailly Pakistan

Figure 4 Herpeto-fauna Abundance and Diversity

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	N	**Evaluation: No adverse impact on aquatic environment in the Indus River is predicted by the water intake.** - The amount of water taken from the river is approx. 0.5 m^3/s. The lowest water flow amount is 177 m^3/sec in December. The intake amount corresponds to approx. 0.3 % of total flow amount. Therefore no adverse impact on aquatic environments is predicted.
	(e) Is there a possibility that discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates will adversely affect the ecosystem of surrounding water areas?	(e)N	**Evaluation: No adverse impact on the ecosystem is predicted.** - As the projet adopts wet type cooling system, no thermal effluent is discharged. - The project needs 0.5 m^3/s of water for the power plant. To avoid fish suction, intake screen is applied at the water intake facility. - All effluents from the power plant is treated to meet the NEQS for effluents.
4 Social Environment			
(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	Y	**Evaluation: Land acquisition will be required for this project.** Alternatives were considered and efforts were made to minimize the impacts of resettlement. Implementation of the power plant project will require 46.25 acres of land but only affect the uncultivated land of three households with a population of 18. Three AHs will only lose 0.87 acre of uncultivated land and no other impacts on their assets and livelihood. Other plots of required land are identified as barren state government land.
	(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	Y	**Evaluation: Adequate explanation on compensation and resettlement assistance will be given to affected people prior to resettlement.** Affected people were consulted and explained adequately during EIA and LARAP studies.
	(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	Y	**Evaluation: Abbreviated Land Acquisition and Resettlement Action Plan (Abbreviated LARAP) was prepared.** LARAP includes compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies.
	(d) Are the compensations going to be paid prior to the resettlement?	Y	**Evaluation: LARAP provides comprehensive policy and procedure of land acquisition.** Compensation will be ensured to be paid prior to the resettlement.
	(e) Are the compensation policies prepared in document?	(e)Y	**Evaluation: LARAP provides comprehensive policy of compensation.**

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	Y	**Evaluation: LARAP provides policy on special assistance for vulnerable groups of people.** Special assistance for vulnerable groups of people is proposed in LARAP but there is no such vulnerable people in project AHs.
	(g) Are agreements with the affected people obtained prior to resettlement?	Y	**Evaluation: Agreements will be made prior to resettlement**.
	(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	Y	**Evaluation: LARAP provides institutional framework.** LARAP propose a plan to secure Capacity and budget
	(i) Are any plans developed to monitor the impacts of resettlement?	Y	**LARAP provides monitoring plan for resettlement.**
	(j) Is the grievance redress mechanism established?	Y	**LARAP provides grievance redress mechanism.**
(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	Y	**Evaluation: Potential adverse impacts on living conditions will be appropriately mitigated and the mitigation measures are addressed in LARAP.** Three AHs will only lose 0.87 acre of uncultivated land and no other impacts on their assets and livelihood.Therefore, no aadverse impact on inhabitants and their living conditions is expected.
	(b) Is sufficient infrastructure (e.g., hospitals, schools, and roads) available for the project implementation? If the existing infrastructure is insufficient, are any plans developed to construct new infrastructure or improve the existing infrastructure?	Y	**Evaluation: Insufficiency of infrastructure due to influx of external labors and construction work activities will be** A camp site will be developed within the LFPS premises to facilitate necessary basic infrastructures for labors during construction period. EIA addresses following social augmentation plans to mitigate insufficiency of the existing local infrastructures; - construction/rehabilitation of drinking water supply scheme - rehabilitation of primary health care clinic in Manzurabad - rehabilitation of basic health unit in Khanot - NGO training services for health care service staff - primary health training equipment and material

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(c) Is there a possibility that large vehicles traffic for transportation of materials, such as raw materials and products will have impacts on traffic in the surrounding areas, impede the movement of inhabitants, and any cause risks to pedestrians?	Y	**Evaluation: Increase in large vehicles traffic is expected but will be mitigated.** All the roads that will be used for the transportation of plant equipment are national highways, dual carriage and have at least 4 lanes. The current volume of traffic on any of the highways ranges from 8,000 to 21,000 vehicles per day. In comparison the volume of traffic generated by the movement of plant equipment is likely to be less than 500 trucks, spread over several weeks. The incremental traffic and consequently the impact will therefore be insignificant. Environmental management measures have been included in the EMP.
	(d) Is there a possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	Y	**Evaluation: Potential risk of infectious diseases during construction period is expected but will be mitigated.** There is a possibility that diseases will be brought due to the immigration of workers. Labor health management plan shall be prepared and disease generation status shall be monitored. The project will implement periodic medical check and conduct education programs on health of workers.
	(e) Is there a possibility that the amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project will adversely affect existing water uses and uses of water areas (especially fishery)?	N	**Evaluation: No significant impact on water resources is predicted.** Volume of existing water flow will be secured not to impact on the local use of the river water. There is no thermal effluents from the proposed Project.
(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	N	**Evaluation: No significant impact on heritage is predicted.** The closest heritage is Syed Daad Shaheed Graveyard located in about 6 km southeast from the candidate site. The proposed Project site is located and kept appropriate distance from the Syed Daad Shaheed Graveyard to avoid impact of noise, vibration and traffic increase.
(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N	**Evaluation: The project does not adversely affect the local landscape.**
(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	N/A	**Evaluation: No ethnic minorities and indigenous peoples exist around the candidate site.**
	(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	N/A	**Evaluation: No ethnic minorities and indigenous peoples exist around the candidate site.**

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	Y	**Evaluation: Project proponent will comply with the relevant law and ordinances** The Municipal Laws such as Pakistan Labor Policy, 2010 are observed.
	(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Y	**Evaluation: Project proponent will comply with the relevant law and ordinances** The following measures are proposed. - Long-time exposure of workers to noise will be restricted. - The workers will be directed to wear personal protective gears. - Construction of temporary first aid station at the working site with nurse. - Establishment of cooperative relationship with the local medical facilities.
	(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Y	**Evaluation: Projects are exposed to the risks of accident and spread of infectious diseases especially during construction period. To control these risks, following mitigation measures are proposed.** - Safety and sanitation management plan will be developed - Regular health check of the labors will be implemented.
	(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Y	**Evaluation: Workers will be educated to comply with the safety of other individuals as well as local residents.** Employed labors may increase impact on female daily activities, privacy of the female and/or increase possibility of abuse to the local female. The contracted labors will be educated and the local communities will be consulted and monitored.
5 Others			
(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y	**Evaluation: Adequate measures are proposed in EMP to reduce impact during construction.**
	(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts?	N/A	**Evaluation: : Project will not adversely affect the natural environment.**
	(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	Y	**Evaluation: Adequate measures on predicted social concerns are proposed in EMP** Social augmentation plan and development of campsite are proposed to mitigate the shortage of local infrastructure. Establishment of a “Recruitment plan” is also proposed to provide appropriate guidance to the local people and avoid any possible social conflicts.

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
(2) Accident Prevention Measures	(a) In the case of coal-fired power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	Y	**Evaluation: Adequate measures for preventing spontaneous combustion at coal piles will be taken.** Prevention measures for spontaneous ignition for coal transportation and coal storage facility will be developed.
(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	**Evaluation: GENCO implements the monitoring program.** (a) GENCO will implement the monitoring: Monitoring Plan for Power Plant" in this report.
	(b) What are the items, methods and frequencies of the monitoring program?	Y	(b) Same as above.
	(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	Y	(c) Same as above.
	(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	Y	**Evaluation: Monitoring format is regulated by national law.** (d) The monitoring format is regulated by NEQS (Self-Monitoring and Reporting by Industry) Rules, 2001.
6 Note			
Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	N	(a) N/A
	(b) Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of port and harbor facilities).	N	(b) N/A
Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems,such as transboundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	Y	**Evaluation: No transboudary of waste is predicted. The project generates 2.7 million ton - CO2 per year from the power plant.** [CO2 reduction measure] - Ultra super critical (USC) pressure boiler is installed, which emit less CO_2 than sub-critical and super critical type. - Carbon Capture System (CCS) is not feasible for the project to adopt so far. In the future, this technology will be considered for

Environmental Checklist for Power Plant

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
			reduction of CO_2 emission.

Source: JICA Survey Team

11 - 2 ENVIRONMENTAL CHECKLIST FOR TRANSMISSION LINE

Environmental Checklist for Transmission Line

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation			
(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	(a)Y	**Evaluation: EIA report has been completed.** (a) The EIA report has been completed as per guidelines of the JICA.
	(b) Have EIA reports been approved by authorities of the host country' government?	(b)N	(b) Not yet. Necessary approval will be obtained by the client, as and where required, to fulfill the EIA condition from EPA Sindh.
	(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	(c)N	(c) Not yet.
	(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(d)N	(d) Not yet.
(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	(a) Y	**Evaluation: Contents of the project and the potential impacts were adequately explained to the local stakeholders.** (a) Public consultation process undertaken by the consultants during the EIA study. Their views are considered in report and due weightage given. After its review by the concerned authorities, the EIA study will be made public.
	(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(b)Y	**Evaluation: The comments from the stakeholders have been reflected to the project design.** (b) The comments obtained from stakeholder meetings have been reflected to the project design and locations.
(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)Y	**Evaluation: Alternative plans have been examined with social and environmental considerations properly.** (a) The alternative plans were examined concerning transmission line routes with social and environmental considerations as well as technology and cost.(see Chapter 11)
2 Pollution Control			
(1) Water Quality	(a) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered?	(a)N	**Evaluation: No possibility of water quality degradation is predicted due to proper mitigation measures.** (a) As water quality degradation from construction activities is expected, erosion controls will be applied which is designated in the EMP. On the other hand, there is no major surface water within the ROW (Right Of Way).
3 Natural Environment			
(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a)N	**Evaluation: There is no protected area with in ROW.** (a) The project site is not located in any protected area.

Environmental Checklist for Transmission Line

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	(a)N	**Evaluation: Not applicable** (a) No forest and ecologically valuable habitats in ROW.
	(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	(b)N	**Evaluation: Not applicable** (b) The project does not encompass any protected habitats of endangered species.
	(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(c)N	**Evaluation: Not applicable** (c) No significant impacts on ecosystem are envisaged.
	(d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock?	(d)Y	**Evaluation: Not applicable** (d) Adequate measures such as construction regulation in the night would be done.
	(e) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?	(e)N	**Evaluation: Not applicable** (e) As there is no forest, wetland, exotic species in the ROW, no negative impact on ecosystem would be anticipated.
	(f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments?	(f)N	**Evaluation: Not applicable** (f) Right of Way (ROW) is located in undeveloped area. However, no extensive loss of natural environments would be expected due to the poor vegetation.
(3) Topography and Geology	(a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?	(a)N	**Evaluation: No slope failures or landslides occur.** (a) The land is plain having no expected damage of land sliding or slipping.
	(b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?	(b)N	**Evaluation: No slope failures or landslides occur.** (b) The land is plain having no expected damage of land sliding or slipping.
	(c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(c)N	**Evaluation: Not applicable** (c) All the solid waste (soils) will be reused in tower foundation after compaction to make the site to original landscape.
4 Social Environment			
(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	(a)N	**Evaluation: There will be no permanent and temporary acquisition of land for the T/Ls.** (a) The project land is barren plain and unused land with few vegetation, no physical obstacles, crops, fruit trees, and other assets. In any case, the towers will be installed without any formal land acquisition and no compensation will be paid based on existing practice of NTDC.
	(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(b)N	**Evaluation: This Project will not involve any affected people.** (b) As a result of EIA and Land Acquisition and Resettlement Plant (LARAP) studies with the help of Revenue staff, the project site were determined to be unregistered. Under Pakistani law, any unregistered land falls under the Province Government. and also this project does not cause any involuntary resettlement.

Environmental Checklist for Transmission Line

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	(c)N	**Evaluation: This project does not involve any involuntary resettlement therefore resettlement plan is not required.**
	(d) Are the compensations going to be paid prior to the resettlement?	(d)N	**Same as above.**
	(e) Are the compensation policies prepared in document?	(e) N	**Same as above.**
	(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	(f) N/	**Same as above.**
	(g) Are agreements with the affected people obtained prior to resettlement?	(g) N	**Same as above.**
	(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(h) N	**Same as above.**
	(i) Are any plans developed to monitor the impacts of resettlement?	(i) N	**Same as above.**
	(j) Is the grievance redress mechanism established?	(j) N	**Same as above.**
(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(a) N	**Evaluation: No significant adverse impact.** (a) No residential structures and economical activities and vulnerable groups of people were observed in the project area. There will be positive impacts to local communities. Project will employ as many local people as possible and use the services and goods offered by local community.
	(b) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	(b)Y	**Evaluation: There is a risk of infectious diseases during construction period.** (b) Local people will be recruited as much as possible and lower the risk of infectious disease transmitted by external workers. The environmental and social management plan fully addresses the issue of communicable diseases and their management.
	(c) Is there any possibility that installation of structures, such as power line towers will cause a radio interference? If any significant radio interference is anticipated, are adequate measures considered?	(c)N	**Evaluation: There is no possibility of radio interference.** (c) The transmission line will pass through remote area that is barren plain land hence; no possibility of radio interference is expected. Moreover T/L distance from natural surface level will be maintained as per international guidelines.
	(d) Are the compensations for transmission wires given in accordance with the domestic law?	(d)N	**Evaluation: No compensation is needed to the transmission wires according to the domestic law.** (d) According to Telegraph Act 1885 of Pakistan, there is no necessity to compensate to the land owners. The land will remain in the custody of the owner and productive for farming. In case land under a tower is not freely accessible for productive use, then the site will be permanently acquired and appropriately compensated. There is no agricultural land on the ROW in this project.

Environmental Checklist for Transmission Line

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)N	**Evaluation: Not applicable** (a) There are no structures /sites of religious or cultural heritage.
(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N	**Evaluation: The project will not affect the local landscape** (a) Necessary measures are proposed.
(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a)N	**Evaluation: Not applicable** (a) The project complies with the country's law for rights of ethnic minorities and indigenous people. However, no such communities are found in the project area.
	(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(b)N	**Evaluation: Not applicable** (b) The project complies with the country's law for rights of ethnic minorities and indigenous people. However, no such communities are found in the RoW.
(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	(a)Y	**Evaluation: Project proponent will comply with the relevant law and ordinances** (a) The Municipal Laws such as Pakistan Labour Policy, 2010 are observed.
	(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	(b)Y	**Evaluation: Appropriate measures to prevent the workers from accidents will be taken** (b) The construction of civil works such as transmission towers and substations poses an inherent risk of injury to workers from accidents and hazardous working environments. A construction phase Occupational Health and Safety Plan (OHSP) will be developed
	(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	(c)Y	**Evaluation: Intangible measures will be planned and implemented** (c). A construction phase Occupational Health and Safety Plan (OHSP) will be developed.
	(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(d)Y	**Evaluation: Appropriate measures will be taken** (d) The appropriate measures would be taken so as to ensure that the security guards will not violate safety of other individuals.
5 Others			
(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	(a)Y	**Evaluation: Adequate measures will be taken to reduce impacts during construction** (a) These are taken care of in the EMP.
	(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	(b)N	(b) N/A

Environmental Checklist for Transmission Line

Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(c)Y	(c) Evaluation: Monitoring will be conducted for outage. Temporary power outage is expected during connection between existing T/Ls and new ones.
(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	(a)Y	**Evaluation: Monitoring program has been developed** (a) Monitoring program has been developed.
	(b) What are the items, methods and frequencies of the monitoring program?	(b)Y	**Evaluation: The items, methods and frequencies are described in Monitoring Plan** (b) The methods and approaches have been adopted in the monitoring plan.
	(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	(c)Y	**Evaluation: Adequate monitoring framework has been established** (c) Proponent has established the monitoring frameworks for pre-construction (design stage), construction and operation phase.
	(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(d)Y	**Evaluation: Monitoring format is regulated by national law.** (d) Monitoring activities will be presented in the regular monthly and quarterly progress reports.
6 Note			
Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	(a)Y	**Evaluation: Relevant items on road checklist are referred.** (a) Air quality, waste, noise and vibration, hydrology are given as the item of check list to concern the road. Appropriate measures would be taken to those items.
Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)N	**Evaluation: Not applicable** (a) The project will not cause any trans boundary impacts.

1) Regarding the term “Country’s Standards” mentioned in the above table, in the appropriate environmental considerations are required to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Source: JICA Survey Team

11 - 3 SINDH ENVIRONMENTAL QUALITY STANDARDS (SEQS)

Sindh Environmental Quality Standards (SEQS)

Following the promulgation of Sindh Environmental Protection Act 2014 (Sindh Act 2014), Sindh has notified its own ambient air quality standards. It is understood that the National Environmental Quality Standards (NEQS) issued prior to Sindh Act 2014 remain in force in Sindh unless they are expressly amended, as is the case with the ambient air quality standards. As the Sindh Act 2014 does not have the provision for a national standards and PEPA 1997 is no longer applicable in Sindh, the term 'Sindh Environmental Quality Standards' is understood to include the NEQS (except ambient air quality standards) issued under PEPA 1997. However, the term NEQS is still used in this document where reference is made to older standards.

(1) Air Quality

Table 1 Comparison of NEQS and IFC Guideline Limits for Gaseous Emissions

No.	Parameter	Source of Emission	National Standards (mg/m^3)	IFC Standards[4] (mg/Nm^3)
1.	Smoke	Smoke opacity not exceed	40% or 2 on Ringlemann Scale or equivalent smoke number	-
2.	Particulate matter[1]	(a) Boilers and furnaces:		Solid Fuels Plant>/=600 MWth
		i) Oil-fired	300	-
		ii) Coal-fired	500	50 (NDA), 30 (DA)
		iii) Cement-kilns	300	-
		(b) Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas	500	-
3.	Hydrogen chloride	Any	400	-
4.	Chlorine	Any	150	-
5.	Hydrogen fluoride	Any	150	-
6.	Hydrogen sulfide	Any	10	-
7.	Sulfur oxides[2, 3]	Any	1,700	200 – 850 (NDA) 200 (DA)
8.	Carbon monoxide	Any	800	-
9.	Lead	Any	50	-
10.	Mercury	Any	10	-
11.	Cadmium	Any	20	-
12.	Arsenic	Any	20	-
13.	Copper	Any	50	-
14.	Antimony	Any	20	-
15.	Zinc	Any	200	-
16.	Oxides nitrogen[3] of	Nitric acid manufacturing unit	3,000	-
		Gas-fired	400	-
		Oil-fired	600	-
		Coal-fired	1,200	510[5] Or up to 1,100 if volatile matter of fuel < 10% (NDA) 200 (DA)

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 per cent sulfur content in fuel oil. Higher content of sulfur will cause standards to be pro-rated.
3. In respect of emissions of sulfur dioxide and nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to

Sindh Environmental Quality Standards (SEQS)

National Environmental Quality Standards (NEQS) above, comply with the standards stated in Table 2 and Table 3.

4. Emissions Guidelines (in mg/Nm^3 or as indicated) for Boiler (IFC EHS Guidelines, Thermal Power Plants, Table 6 (c))
5. Stoker boilers may require different emissions values which should be evaluated on a case-by-case basis through the EA process.

Source: JICA Survey Team

Table 2 Comparison of NEQS and IFC Guideline Limits for Sulphur Dioxide for Power Plants Operating on Oil and Coal

National Standards					IFC Standards	
Sulfur Dioxides Background Levels (µg/m^3)			Criterion I	Criterion II		
Background Air Quality (SO_2 basis)	Annual Average	Maximum 24-Hour	Max. SO_2 Emissions (TPD)	Max. Allowable 1-Year Average Ground Level Increment to Ambient (µg/m^3)	Emission for Boiler >/=600MWht (mg/Nm^3)	WHO Ambient Air Quality Guidelines (µg/m^3)
Unpolluted	< 50	< 200	500	50	200 - 850 [3]	<24-hour> 125 (Interim target 1) 50 (Interim target 2) 20 (guideline) <10 minute> 500 (guideline)
Moderately polluted[1]					200	
Low	50	200	500	50		
High	100	400	100	10		
Very polluted[2]	> 100	> 400	100	10		

1. For intermediate values between 50 and 100 µg/m^3 linear interpretation should be used.
2. No project with sulfur dioxide emissions will be recommended.
3. Targeting the lower guidelines values and recognizing variability in approaches to the management of SO_2 emissions (fuel quality vs. use of secondary controls) and the potential for higher energy conversion efficiencies (FGD may consume between 0.5% and 1.6% of electricity generated by the plant). Large plants are expected to have additional emission control measures. Selection of the emission level in the rage is to be determined by EA considering the project's sustainability, development impact, and cost-benefit of the pollution control performance.

Source: JICA Survey Team

Table 3 Comparison of NEQS and IFC Guideline Limits for Nitrogen Oxides for Power Plant Operating on Oil and Coal

National Standards		IFC Standards (mg/Nm^3)	
		NDA [1]	DA [1]
Annual arithmetic mean of ambient air concentrations of nitrogen oxides (expressed as NO_2) should not exceed.	100µg/m^3 (0.05 ppm)	40 (guideline)	
Maximum emission levels for stationary source discharges, before mixing with the atmosphere: For fuel fired steam generators.		Solid Fuels (Plant >/=600 MWth)	
Liquid fossil fuel	130 ng/J of heat input	400	200
Solid fossil fuel	300 ng/J of heat input	510 [2]	200
Lignite fossil fuel	260 ng/J of heat input	Or up to 1,100 if volatile matter of fuel < 10%	

1. NDA = Non-degraded airshed; DA = Degraded airshed (poor air quality); Airshed should be considered as being degraded if nationally legislated air quality standards are exceeded or, in their absence, if WHO Air Quality Guidelines are exceeded significantly.
2. Stoker boilers may require different emissions values which should be evaluated on a case-by-case basis through the EA process.

Source: JICA Survey Team

Sindh Environmental Quality Standards (SEQS)

Table 4 Comparison of SEQS and IFC Guideline Limits for Ambient Air Quality

Pollutants	Time-weighted Average	Concentration in Ambient Air	Method of Measurement	IFC Standards **** ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	Annual Average *	80 $\mu g/m^3$	-Ultra Violet Fluorescence method	-
	24 hours **	120 $\mu g/m^3$		125 (Interim target 1) 50 (Interim target 2) 20 (guideline)
Oxide of Nitrogen as (NO)	Annual Average *	40 $\mu g/m^3$	-Gas Phase Chemiluminescence	-
	24 hours **	40 $\mu g/m^3$		-
Oxide of Nitrogen as (NO_2)	Annual Average *	40 $\mu g/m^3$	-Gas Phase Chemiluminescence	40 (guideline)
	24 hours **	80 $\mu g/m^3$		-
O_3	1 hour	130 $\mu g/m^3$	-Non dispersive UV absorption method	-
Suspended Particulate Matter (SPM)	Annual Average *	360 $\mu g/m^3$	-High Volume Sampling, (Average flow rate not less than 1.1 m^3/min)	-
	24 hours **	500 $\mu g/m^3$		-
Respirable particulate Matter. PM_{10}	Annual Average *	120 $\mu g/m^3$	-β Ray Absorption method	70 (Interim target 1) 50 (Interim target 2) 30 (Interim target 3) 20 (guideline)
	24 hours **	150 $\mu g/m^3$		150 (Interim target 1) 100 (Interim target 2) 75 (Interim target 3) 50 (guideline)
Respirable Particulate Matter. $PM_{2.5}$	Annual Average *	40 $\mu g/m^3$ ***	-β Ray Absorption method	35 (Interim target 1) 25 (Interim target 2) 15 (Interim target 3) 10 (guideline)
	24 hours **	75 $\mu g/m^3$		75 (Interim target 1) 50 (Interim target 2) 37.5 (Interim target 3) 25 (guideline)
Lead (Pb)	Annual Average *	1 $\mu g/m^3$	ASS Method after sampling using EPM 2000 or equivalent Filter paper	-
	24 hours **	1.5 $\mu g/m^3$		-
Carbon Monoxide (CO)	8 hours **	5 mg/m^3	Non Dispersive Infra Red (NDIR) method	-
	1 hour	10 mg/m^3		-

* Annual arithmetic mean of minimum 104 instruments in a year taken twice a week 24 hourly at uniform interval
** 24 hourly /8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.
*** or 9 $\mu g/m^3$ plus baseline, whichever is low.
**** WHO Ambient Air Quality Guidelines (IFC General EHS Guidelines, Air Emissions and Ambient Air Quality, Table 1.1.1)

Source: JICA Survey Team

(2) Water Quality

Comparisons of NEQS and IFC guideline for effluents and Pakistan Standard and WHO guideline limits for drinking water are shown in Table 5 and Table 6.

Sindh Environmental Quality Standards (SEQS)

Table 5 Comparison of NEQS and IFC Guideline Limits for Effluents
(mg/l, unless otherwise defined)

No.	Parameter	Standards			IFC Guidelines
		Into Inland Waters	**Into Sewage Treatment** [1]	**Into Sea** [2]	
1.	Temperature increase [3]	=<3°C	=<3°C	=<3°C	- [10]
2.	pH value	6 to 9	6 to 9	6 to 9	6 to 9
3.	Five-day bio-chemical oxygen demand (BOD) [5] at 20°C [4]	80	250	80 [5]	-
4.	Chemical oxygen demand (COD) [1]	150	400	400	-
5.	Total suspended solids (TSS)	200	400	200	50
6.	Total dissolved solids (TDS)	3,500	3,500	3,500	-
7.	Grease and oil	10	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3	-
9.	Chlorides (as Cl')	1,000	1,000	SC [6]	-
10.	Fluorides (as F')	10	10	10	-
11.	Cyanide total (as CN')	1.0	1.0	1.0	-
12.	Anionic detergents (as MBAS) [7]	20	20	20	-
13.	Sulfates (SO4)	600	1,000	SC [6]	-
14.	Sulfides (s')	1.0	1.0	1.0	-
15.	Ammonia (NH3)	40	40	40	-
16.	Pesticides [8]	0.15	0.15	0.15	-
17.	Cadmium [9]	0.1	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent) [9]	1.0	1.0	1.0	0.5
19.	Copper [9]	1.0	1.0	1.0	0.5
20.	Lead [9]	0.5	0.5	0.5	0.5
21.	Mercury [9]	0.01	0.01	0.01	0.005
22.	Selenium [9]	0.5	0.5	0.5	-
23.	Nickel [9]	1.0	1.0	1.0	-
24.	Silver [9]	1.0	1.0	1.0	-
25.	Total toxic metals	2.0	2.0	2.0	-
26.	Zinc	5.0	5.0	5.0	1.0
27.	Arsenic [9]	1.0	1.0	1.0	0.5
28.	Barium [9]	1.5	1.5	1.5	-
29.	Iron	8.0	8.0	8.0	1.0
30.	Manganese	1.5	1.5	1.5	-
31.	Boron [9]	6.0	6.0	6.0	-
32.	Chlorine	1.0	1.0	1.0	0.2

Explanations:

1. Applicable only when and where sewage treatment is operational and BOD = 80 mg/l is achieved by the sewage treatment system.
2. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
3. The effluent should not result in temperature increase of more than 3oC at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not define, use 100 m from the point of discharge
4. Assuming minimum dilution 1:10 discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
5. The value for industry is 200 mg/l
6. Discharge concentration at or below sea concentration (SC)

Sindh Environmental Quality Standards (SEQS)

7. Methylene Blue Active substances assuming surfactant as biodegradable
8. Pesticides include herbicides, fungicides, and insecticides
9. Subject to total toxic metals discharge should not exceed level given at S. No. 25
10. IFC General Guidelines describes "temperature of wastewater prior to discharge does not result in an increase greater than 3 °C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations".

Notes:

1. Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.
2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the NEQS limits.

Source: JICA Survey Team

Table 6 Comparison of Standards for Drinking Water

Properties/ Parameters	***Standard Values For Pakistan***	***WHO Guidelines***	***Remarks***
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Note 1
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Note 1
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Note 1
Physical			
Colour	≤15 TCU	≤15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non objectionable/Acceptable	Non objectionable/Acceptable	
Turbidity	< 5 NTU	< 5 NTU	
Total hardness as $CaCO_3$	< 500 mg/l	–	
TDS	< 1000	< 1000	
pH	6.5 – 8.5	6.5 – 8.5	
Chemical			
Essential Inorganic	mg/Litre	mg/Litre	
Aluminium (Al) mg/1	<0.2	0.2	
Antimony (Sb)	<0.005 (P)	0.02	
Arsenic (As)	< 0.05 (P)	0.01	Note 2
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Note 2
Chloride (Cl)	<250	250	
Chromium (Cr)	<0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	mg/Litre	mg/Litre	
Cyanide (CN)	<0.05	0.07	Note 2
Fluoride (F)*	<1.5	1.5	
Lead (Pb)	<0.05	0.01	Note 2
Manganese (Mn)	< 0.5	0.5	
Mercury (Hg)	<0.001	0.001	
Nickel (Ni)	<0.02	0.02	

Sindh Environmental Quality Standards (SEQS)

Nitrate (NO_3)*	<50	50	
Nitrite (NO_2)*	<3 (P)	3	
Selenium (Se)	0.01(P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	–	
Zinc (Zn)	5.0	3	Note 2
* indicates priority health related inorganic constituents which need regular monitoring.			
Organic Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted. ***	Annex II
Phenolic compounds (as Phenols) mg/L		< 0.002	
Polynuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Provision:

1. The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The arsenic concentrations in South Punjab and in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centres are generally old and will take significant resources and time to get them replaced. In the recent past, lead was completely phased out from petroleum products to cut down lead entering into environment. These steps will enable to achieve WHO Guidelines for Arsenic, Lead, Cadmium and Zinc. However, for the bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Notes:

1. Most Asian countries also follow WHO standards
2. Standard for Pakistan similar to most Asian developing countries

Source: JICA Survey Team

(3) Other Regulations

Comparison of NEQS and IFC guideline limits for noise is shown in Table 7 and Table 8.

Table 7 Comparison of NEQS and IFC Guideline Limits for Emission from Vehicle and Noise

No.	Parameter	Standards (Maximum Permissible Limit)		Measuring Method	IFC Standards
1.	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.		To compared with Ringlemann chart at a distance of 6 meters or more.	N/A
2.	Carbon Monoxide	Emission Standards:			N/A
		New Vehicles	Used Vehicles		
		4.5%	6%	Under idling conditions: Nondispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)		Sound-meter at 7.5 meters from the source.	N/A

Source: JICA Survey Team

Sindh Environmental Quality Standards (SEQS)

Table 8 Comparison of NEQS and IFC Guideline Limits for Noise

No.	Category of Area/Zone	National Standards				IFC Standards	
		Effective from 1st July, 2010		Effective from 1st July, 2012		One Hour LAeq (dBA)	
		Limit in dB(A) Leq [5]					
		Day time [1]	Night time [2]	Day time	Night time	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
1.	Residential area (A)	65	50	55	45	55 [1]	45 [1]
2.	Commercial area (B)	70	60	65	55	70 [2]	70 [2]
3.	Industrial area (C)	80	75	75	65	70 [2]	70 [2]
4.	Silence zone (D) [3]	55	45	50	45	-	-

Note (National Standards):

1. Day time hours: 6.00 am to 10.00 pm
2. Night time hours: 10.00 pm to 6.00 am
3. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.
4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.
5. dB (A) Leq: time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Note (IFC Standards):

1. Residential, institutional and educational: 55 dBA (Daytime) and 45 dBA (Nighttime)
2. Industrial and commercial: 70 dBA (Daytime) and 70 dBA (Nighttime)

Source: JICA Survey Team

11 - 4 MONITORING FORM

Monitoring Form

1. Monitoring Form for Power Plant

Monitoring Form

1. Monitoring Form (during construction)

The latest results of the below monitoring items shall be submitted to the lenders as part of Quarterly Progress report throughout the construction phase.

Construction Phase

(1) Response/Actions to Comments and Guidelines from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments made by the public.	
Numer and contents of responces from Government agencies	

(2) Pollution

- General

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Handling and storage of parts and equipment at plant		Visual inspection	Work sites	Daily
Top soil		Top soil of 0.5 m depth will be excavated and stored properly	Construction area	Beginning of earth filling works
Erosion		Visual inspection of erosion prevention measures and occurrence of erosion	Construction areas and material storage sites	Monthly
Hydrocarbon and chemical storage		Visual inspection of storage facilities	Construction sites	Monthly
Local roads		Visual inspection to ensure local roads are not damaged	Approach roads	Monthly
Traffic safety		Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Haul roads	Monthly

Monitoring Form

- Air (Ambient Air Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
PM_{10}	$\mu g/m^3$			120 (Annual Average)	SEQS	70 (IT-1) 50 (IT-2) 30 (IT-3) 20 (guideline)	a) locations where the impact of power plant, road traffic, and other sources are minimal b) locations near the N-55 c) locations near maximum ground level concentration (GLC) d) sensitive receptors	Suggested frequency is continuously at two locations (fixed station) and once in a month at other locations for one day.
	$\mu g/m^3$			150 (24 hours)	SEQS	150 (IT-1) 100 (IT-2) 75 (IT-3) 50 (guideline)		
$PM_{2.5}$	$\mu g/m^3$			40 (Annual Average)	SEQS	35 (IT-1) 25 (IT-2) 15 (IT-3) 10 (guideline)		
	$\mu g/m^3$			75 (24 hours)	SEQS	75 (IT-1) 50 (IT-2) 37.5 (IT-3) 25 (guideline)		
SO_2	$\mu g/m^3$			80 (Annual Average)	SEQS	-		
	$\mu g/m^3$			120 (24 hours)	SEQS	125 (IT-1) 50 (IT-2) 20 (guideline)		
CO	mg/m^3			5 (8 hours)	SEQS	-		
	mg/m^3			10 (1 hour)	SEQS	-		
NO_2	$\mu g/m^3$			40 (Annual Average)	SEQS	40 (guideline)		
	$\mu g/m^3$			80 (1 hour)	SEQS	-		

Monitoring Form

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Dust, smoke		Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Construction sites	Daily
		Visual inspection to ensure dust suppression work plan is being implemented	Material storage sites	Monthly

- Noise

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
Noise	dB			75 (day time) 65 (night time) [Industrial area]	NEQS	70 (day time) 70 (night time)	Construction site Boundary area of the power plant Nearest residence or primary school	Quarterly

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Noise		Visual inspection to ensure good standard equipment is in use	Construction site Boundary area of the power plant Nearest residence or primary school	Weekly

- Water Quality

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Drinking water and sanitation		Ensure the construction workers are provided with safe water and sanitation facilities in the site	In construction sites and construction camps	Monthly
River water pollution by effluent		Ensure the construction workers are provided with sanitation facilities (temporary lavatories) in the site	Construction sites along the Indus River	Monthly

Monitoring Form

- Waste Management

Municipal waste, industrial waste, hazardous waste		Visual inspection that solid waste is disposed at designated site	Construction camps and construction sites	Monthly

- Odor

Kitchen waste		Visual inspection that those wastes are disposed of at designated sites	Waste storage facility	Monthly
Septic tank		Visual inspection that the lavatories are properly managed.	Lavatory	Monthly

(3) Socio-economics

- Cultural and archeological sites

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Cultural and archeological sites		Visual observation for chance finding	At all work sites	Daily

- Reinstatement of work sites

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Reinstatement of work sites		Visual inspection	At all work sites	After completion of all works

- Infectiuos Diseases

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Infectous diseases		The number of reported infections	Construction sites	Regular health checks

Monitoring Form

- Accidents and Safety

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Accidents and safety		Numbers, contens, and procesing results of diseases, accsident if occurred.	Construction site	Every day

- Safety of Workers

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Safety of workers		Usage of Personal Protective equipment	At work sites	Monthly

- Gender

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Gender		Status of the Grievance Redress Mechanisms (GRM) establishment, The number of grievance	Project site	Monthly

Monitoring Form

Operation Phase

(1) Response/Actions to Comments and Guidelines from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Number and contents of formal comments made by the public.	
Numer and contents of responces from Government agencies	

(2) Pollution

- Air (Stack Emission)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
SO_2	mg/m^3			100 - 500 Tons per day	SEQS(NEQS)	200 - 850	Prior to pre-treatment in ESP, FGD and at the exit of the stack	Continuous monitoring
NOx	mg/m^3			260 ng/J of heat input 1,200 mg/Nm^3	SEQS(NEQS)	510		
CO	mg/m^3			800	SEQS(NEQS)	-		
PM_{10}	mg/m^3			500	SEQS(NEQS)	50		
$PM_{2.5}$	mg/m^3			500	SEQS(NEQS)	50		
Exit gas temp.	deg C			-	-	-		
Exit gas speed	m/sec			-	-	-		

Monitoring Form

- Air (Ambient Air Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
PM_{10}	$\mu g/m^3$			120 (Annual Average)	SEQS	70 (IT-1) 50 (IT-2) 30 (IT-3) 20 (guideline)	Near sensitive sites and settlements	Suggested frequency is: Continuously at two location (fixed station) and once every month at other locations for one day
	$\mu g/m^3$			150 (24 hours)	SEQS	150 (IT-1) 100 (IT-2) 75 (IT-3) 50 (guideline)		
$PM_{2.5}$	$\mu g/m^3$			40 (Annual Average)	SEQS	35 (IT-1) 25 (IT-2) 15 (IT-3) 10 (guideline)		
	$\mu g/m^3$			75 (24 hours)	SEQS	75 (IT-1) 50 (IT-2) 37.5 (IT-3) 25 (guideline)		
SO_2	$\mu g/m^3$			80 (Annual Average)	SEQS	-		
	$\mu g/m^3$			120 (24 hours)	SEQS	125 (IT-1) 50 (IT-2) 20 (guideline)		
CO	mg/m^3			5 (8 hours)	SEQS	-		
	mg/m^3			10 (1 hour)	SEQS	-		
NO_2	$\mu g/m^3$			40 (Annual Average)	SEQS	40 (guideline)		
	$\mu g/m^3$			80 (24 hours)	SEQS	-		

Monitoring Form

- Water Quality (Effluent)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
Temperature	ºC			≤ 3 ºC	SEQS(NEQS)	-	At the point where effluent leaves within the plant boundary	Monthly
pH	-			6 to 9	SEQS(NEQS)	6 to 9		
BOD	mg/l			80	SEQS(NEQS)	-		
COD	mg/l			150	SEQS(NEQS)	-		
TSS	mg/l			200	SEQS(NEQS)	50		
Oil & grease	mg/l			10	SEQS(NEQS)	10		
TDS	mg/l			3500	SEQS(NEQS)	-		
Zn	mg/l			5.0	SEQS(NEQS)	1	At the point where effluent leaves within the plant boundary	Quarterly
Pb	mg/l			0.5	SEQS(NEQS)	0.5		
Ni	mg/l			1.0	SEQS(NEQS)	-		
Fe	mg/l			8.0	SEQS(NEQS)	1		
Hg	mg/l			0.01	SEQS(NEQS)	0.005		
Cu	mg/l			1.0	SEQS(NEQS)	0.5		
Co	mg/l			2.0	SEQS(NEQS)	-		
Cr	mg/l			1.0	SEQS(NEQS)	0.5		
As	mg/l			1.0	SEQS(NEQS)	0.5		
Cd	mg/l			0.1	SEQS(NEQS)	0.1		

Monitoring Form

- Water Quality (Goundwater)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS for values for Drinking water	Standards for Contract	WHO Guidelines for drinking watr	Measurement Point	Frequency
Temperature	ºC				SEQS(NEQS)	-	Groundwater around the ash pond	Monthly
TDS	-			6.5 to 8.5	SEQS(NEQS)	6.5 to 8.5		
Aluminum	mg/l			0.2	SEQS(NEQS)	0.2		
Antimony	mg/l			0.005	SEQS(NEQS)	0.02		
Arsenic	mg/l			0.05	SEQS(NEQS)	0.01		
Barium	mg/l			0.7	SEQS(NEQS)	0.7		
Boron	mg/l			0.3	SEQS(NEQS)	0.3		
Cadmium	mg/l			0.01	SEQS(NEQS)	0.003		
Chloride	mg/l			250.0	SEQS(NEQS)	250		
Chromium	mg/l			0.05	SEQS(NEQS)	0.05		
Copper	mg/l			2	SEQS(NEQS)	2		
Cyanide	mg/l			0.05	SEQS(NEQS)	0.07		
Fluoride	mg/l			1.5	SEQS(NEQS)	1.5		
Lead	mg/l			0.05	SEQS(NEQS)	0.01		
Manganese	mg/l			0.5	SEQS(NEQS)	0.5		
Mercury	mg/l			0.001	SEQS(NEQS)	0.001		
Nickel	mg/l			0.02	SEQS(NEQS)	0.02		
Nitrate	mg/l			50	SEQS(NEQS)	50		
Nitrite	mg/l			3	SEQS(NEQS)	3		
Selenium	mg/l			0.01	SEQS(NEQS)	0.01		
Residual chlorine	mg/l			0.5 to 1.5 at source	SEQS(NEQS)	-		
Zinc	mg/l			5	SEQS(NEQS)	3		

Monitoring Form

- Noise

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	NEQS /SEQS	Standards for Contract	IFC Standards	Measurement Point	Frequency
Noise	dB			75 (day time) 65 (night time) [Industrial area]	NEQS	70 (day time) 70 (day time)	- Boundary area of the power plant - Nearest residence or primary school	Quarterly

(3) Natural Environment

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Fish fauna			At three locations: 1) Upstream of Project site 2) Point of effluent discharge 3) Downstream of Project site	Annualy in November

(4) Social Environment

Item	Monitoring results during report period	Measures to be taken	Location	Frequency
Grievances on land acquisition, resettlement, living & livelihood, land use, water & social infrastructure, social conflicts, unevenness of project benefits			N/A	Everyday
Report on working condition and accident			Power plant	Everyday

Monitoring Form

2. Monitoring Form for Transmission Lines

1. Monitoring Form (during construction)

The latest results of the below monitoring items shall be submitted to the lenders as part of Quarterly Progress report throughout the

Construction Phase

(1) Response/Actions to Comments and Guidelines from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Conditions laid down in the EIA approval issued from EPA.	The compliance reports shall be submitted to EPA on regular basis.

(2) Pollution

- Waste

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Waste disposal status		Visual observatin	Construction sites	Annualy in November

Note: Needed only during construction and there are no impacts during operational phase

(3) Social Environment

- Existing Social Infrastructure and Services

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Occurrence and Recocery of Outages		Visual observatin	Local residents and institutions such as clinics and schools	Continuously during the process of connecting the proposed and the existing transmission lines

- Infectious Diseases

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Implementation status of mitigation measures proposed in the EMP, the reported number of infections		Visual observatin	Project site, camp sites	Biannually

- Accidents and Safety

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Implementation status of mitigation measures proposed in the EMP, occurrence of accidents and health issues			Project site	Everyday

Monitoring Form

2. Monitoring Form (during operation)

The latest results of the below monitoring items shall be submitted to the lenders on biannual basis for the first two years of operation.

Operation Phase

(1) Natural Environment

Item	Monitoring results during report period	Measures to be taken	Measurement Point	Frequency
Birds Monitoring (Bird strikes)			T/L Corridor	June - August

Note: Needed only during operational phase

11 - 5 SENSITIVE RECEPTORS

Sensitive Receptors

USEPA regulatory model AERMOD was used to simulate criteria pollutants from major sources in the project area and predict air quality for SO_2, NO_2 and PM_{10} and $PM_{2.5}$.

Model Area

A 10 km by 10 km area with the proposed power plant's stack in the center was selected as the modeling area.

Meteorological Data

A pre-processed hourly meteorological data for the study area for 2009, 2010, and 2011 were purchased and used in the model. A monthly summary of the meteorological data is given in Table 1.

Table 1: Summary of 2009, 2010 and 2011 Meteorological Data Input to AERMOD

Month	Wind		Temperature (^oC)		Relative Humidity (%)	
	Max. Speed (m/s)	Predominant Direction	Min	Max	Min	Max
Jan	11.0	N	10.0	28.8	15	95
Feb	11.3	N	12.2	34.2	13	91
Mar	15.1	SW	15.9	40.0	7	97
Apr	15.8	SW	20.9	43.6	5	88
May	17.8	SW	25.6	45.0	10	90
Jun	17.2	SW	23.8	45.9	10	93
Jul	18.2	SW	26.3	42.7	25	96
Aug	15.1	SW	24.6	38.4	38	98
Sept	14.4	SW	23.8	36.8	31	99
Oct	12.7	N	19.6	39.6	11	97
Nov	12.0	N	16.0	36.3	17	95
Dec	11.3	N	9.7	29.8	14	89

Sensitive Receptors

Sensitive receptors such as schools and hospitals were incorporated in the model area to assess the impact of air quality on those areas. The list of sensitive receptors, their locations and details are given in Table 2. These are also shown in Figure 1 to 3.

Table 2: Details of Sensitive Receptors

Facilities Type and Name	Settlement in which Facility is located	Easting	Northing
Educational Facilities			
Government Primary School	Allah Dino Baricho	68° 17' 26.916" E	25° 43' 37.704" N
Government Primary School	Bhuro Khan Rind	68° 17' 39.084" E	25° 43' 8.508" N
Government Primary School	Dodo Mithano	68° 17' 30.300" E	25° 45' 6.696" N

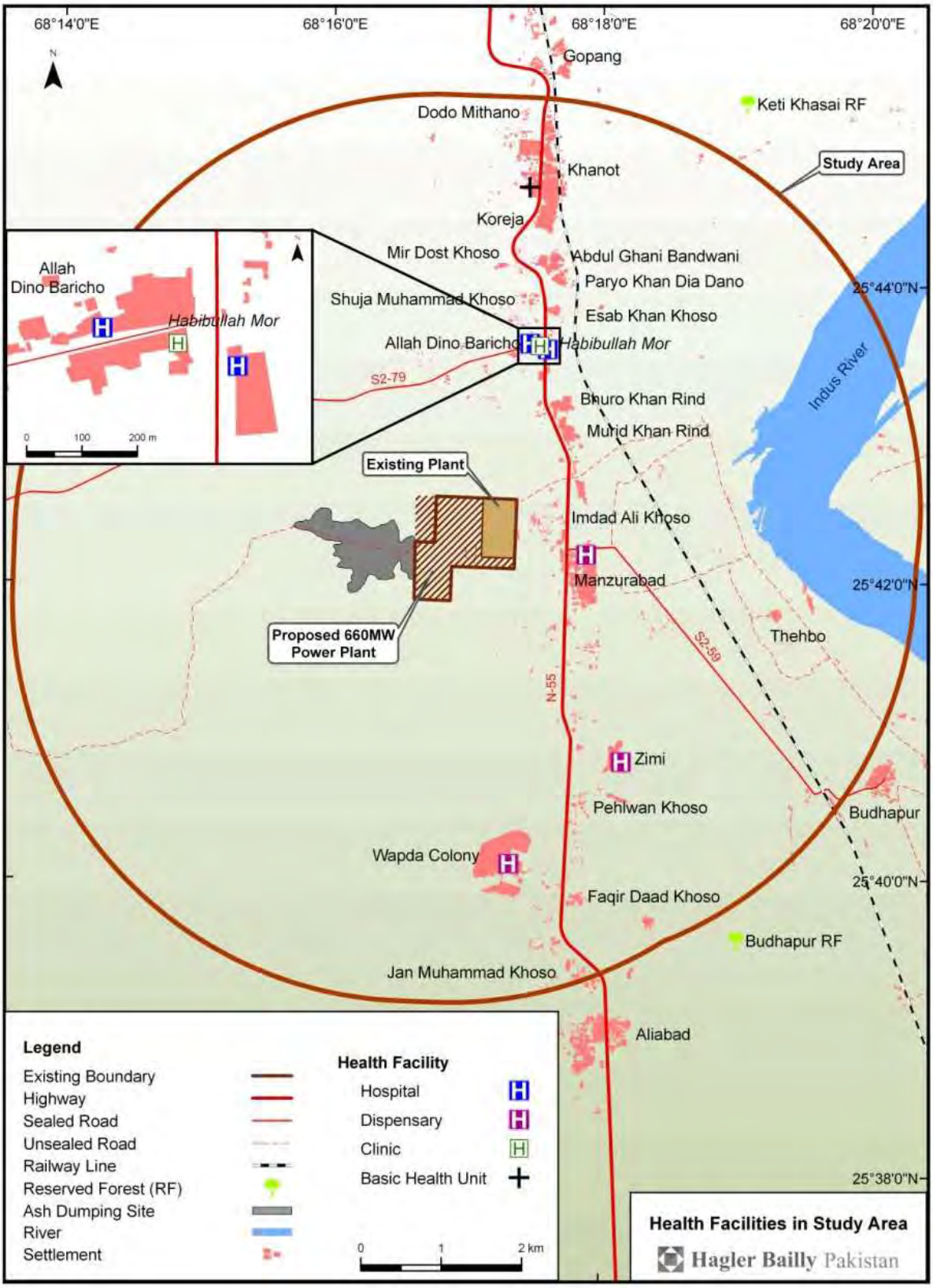
Sensitive Receptors

Facilities Type and Name	Settlement in which Facility is located	Easting	Northing
Government Primary School	Imdad Ali Khoso	68° 17' 36.204" E	25° 42' 16.812" N
Government Primary School Boys	Khanot	68° 17' 33.000" E	25° 44' 49.812" N
Government Primary School Girls	Khanot	68° 17' 37.392" E	25° 44' 42.504" N
Indus Resource Center Elementary School	Khanot	68° 17' 39.588" E	25° 44' 43.512" N
Government High School	Koreja	68° 17' 29.508" E	25° 44' 36.096" N
Government Primary School Boys	Koreja	68° 17' 39.012" E	25° 44' 29.796" N
Government Primary School Girls	Koreja	68° 17' 29.616" E	25° 44' 25.512" N
Government High School	Manzurabad	68° 17' 53.412" E	25° 42' 9.288" N
Government Primary School	Manzurabad	68° 17' 34.584" E	25° 42' 16.992" N
Government Primary School Girls	Manzurabad	68° 17' 50.388" E	25° 41' 54.816" N
Indus Resource Center Elementary School	Manzurabad	68° 17' 52.188" E	25° 42' 3.384" N
Government Primary School	Paryo Khan Dia Dano	68° 17' 47.004" E	25° 44' 1.608" N
Sindh Education Foundation Primary School	Paryo Khan Dia Dano	68° 17' 39.408" E	25° 44' 2.904" N
Government Primary School	Shuja Muhammad Khoso	68° 17' 30.408" E	25° 43' 46.092" N
Elementary School City School	WAPDA Colony	68° 17' 23.892" E	25° 40' 0.084" N
Sindh Education Foundation High School	WAPDA Colony	68° 17' 23.100" E	25° 39' 56.808" N
Government Primary School	Zimi	68° 18' 7.200" E	25° 40' 50.700" N
Government Primary School Boys	Murid Khan Rind	68° 17' 46.392" E	25° 42' 53.388" N
Government Primary School Girls	Murid Khan Rind	68° 17' 44.988" E	25° 42' 56.016" N
Government Primary School Boys	Thehbo	68° 19' 14.700" E	25° 41' 47.004" N
Government Primary School Boys	Faqir Daad Khoso	68° 17' 49.740" E	25° 39' 52.236" N
Health Facilities			
Hospital	Allah Dino Baricho	68° 17' 27.816" E	25° 43' 36.516" N
Basic Health Unit	Khanot	68° 17' 27.384" E	25° 44' 39.696" N
Dispensary	WAPDA Colony	68° 17' 19.284" E	25° 40' 6.312" N
Dispensary	Manzurabad	68° 17' 53.304" E	25° 42' 11.304" N
Dispensary	Zimi	68° 18' 9.216" E	25° 40' 47.604" N
Hospital	Habibullah Mor	68° 17' 35.700" E	25° 43' 34.284" N
Clinic	Habibullah Mor	68° 17' 32.208" E	25° 43' 35.616" N
Religious Places			
Mosque	Manzurabad	68° 17' 54.996" E	25° 42' 2.700" N
Mosque	Manzurabad	68° 17' 55.392" E	25° 41' 57.408" N
Mosque	Zimi	68° 18' 6.588" E	25° 40' 49.512" N
Mosque	Imdad Ali Khoso	68° 17' 35.016" E	25° 42' 17.604" N
Mosque	Imdad Ali Khoso	68° 17' 40.704" E	25° 42' 24.012" N

Sensitive Receptors

Facilities Type and Name	Settlement in which Facility is located	Easting	Northing
Mosque	Imdad Ali Khoso	68° 17' 43.116" E	25° 42' 18.000" N
Mosque	Shuja Muhammad Khoso	68° 17' 31.884" E	25° 43' 53.796" N
Mosque	Bhuro Khan Rind	68° 17' 39.192" E	25° 43' 9.804" N
Mosque	Jan Muhammad Khoso	68° 17' 46.392" E	25° 39' 27.288" N
Mosque	Khanot	68° 17' 30.300" E	25° 44' 44.592" N
Mosque	Khanot	68° 17' 30.912" E	25° 44' 50.892" N
Mosque	Dodo Mithano	68° 17' 34.008" E	25° 45' 4.896" N
Mosque	Khanote	68° 17' 35.304" E	25° 44' 40.704" N
Mosque	Paryo Khan Dia Dano	68° 17' 46.896" E	25° 44' 0.312" N
Mosque	Koreja	68° 17' 38.616" E	25° 44' 30.516" N
Mosque	Allah Dino Baricho	68° 17' 25.908" E	25° 43' 35.796" N
Mosque	Murid Khan Rind	68° 17' 46.284" E	25° 42' 46.296" N
Mosque	Mir Dost Khoso	68° 17' 29.004" E	25° 44' 9.096" N
Mosque	Abdul Ghani Bandwani	68° 17' 16.692" E	25° 40' 2.784" N
Eid Gah	Shuja Muhammad Khoso	68° 17' 31.200" E	25° 43' 45.516" N
Eid Gah	Murid Khan Rind	68° 17' 45.492" E	25° 42' 54.504" N
Hindu Temple	Thehbo	68° 19' 17.112" E	25° 41' 46.716" N
Shrine (Budhal Shah)		68° 17' 59.784" E	25° 43' 51.384" N
Shrine (Daad Shaheed)		68° 18' 20.988" E	25° 39' 43.524" N
Eid Gah	Manzurabad	68° 17' 38.616" E	25° 42' 2.880" N

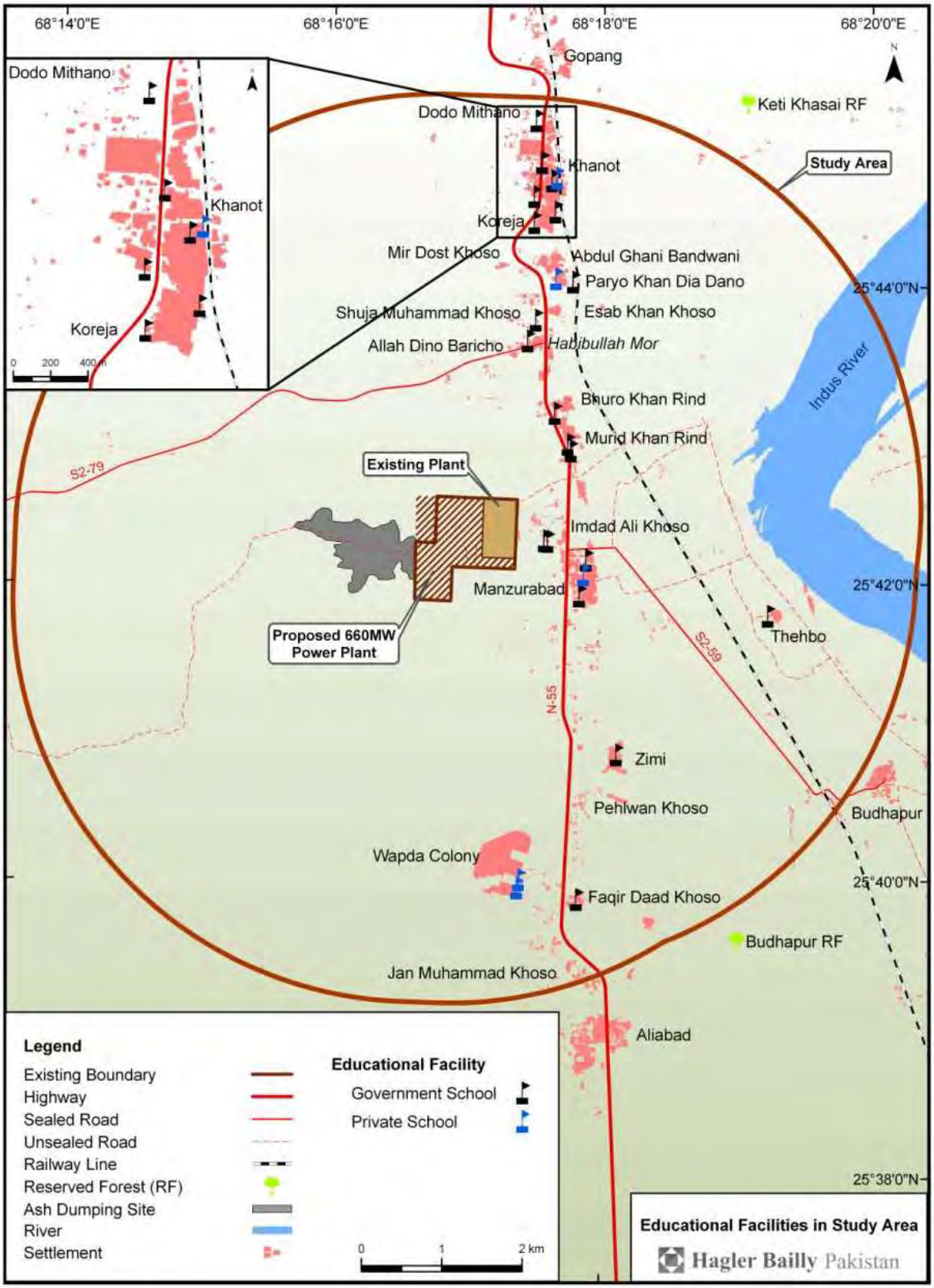
Sensitive Receptors



Source: Hagler Bailly Pakistan

Figure 1: Location of Sensitive Receptors – Health Facilities

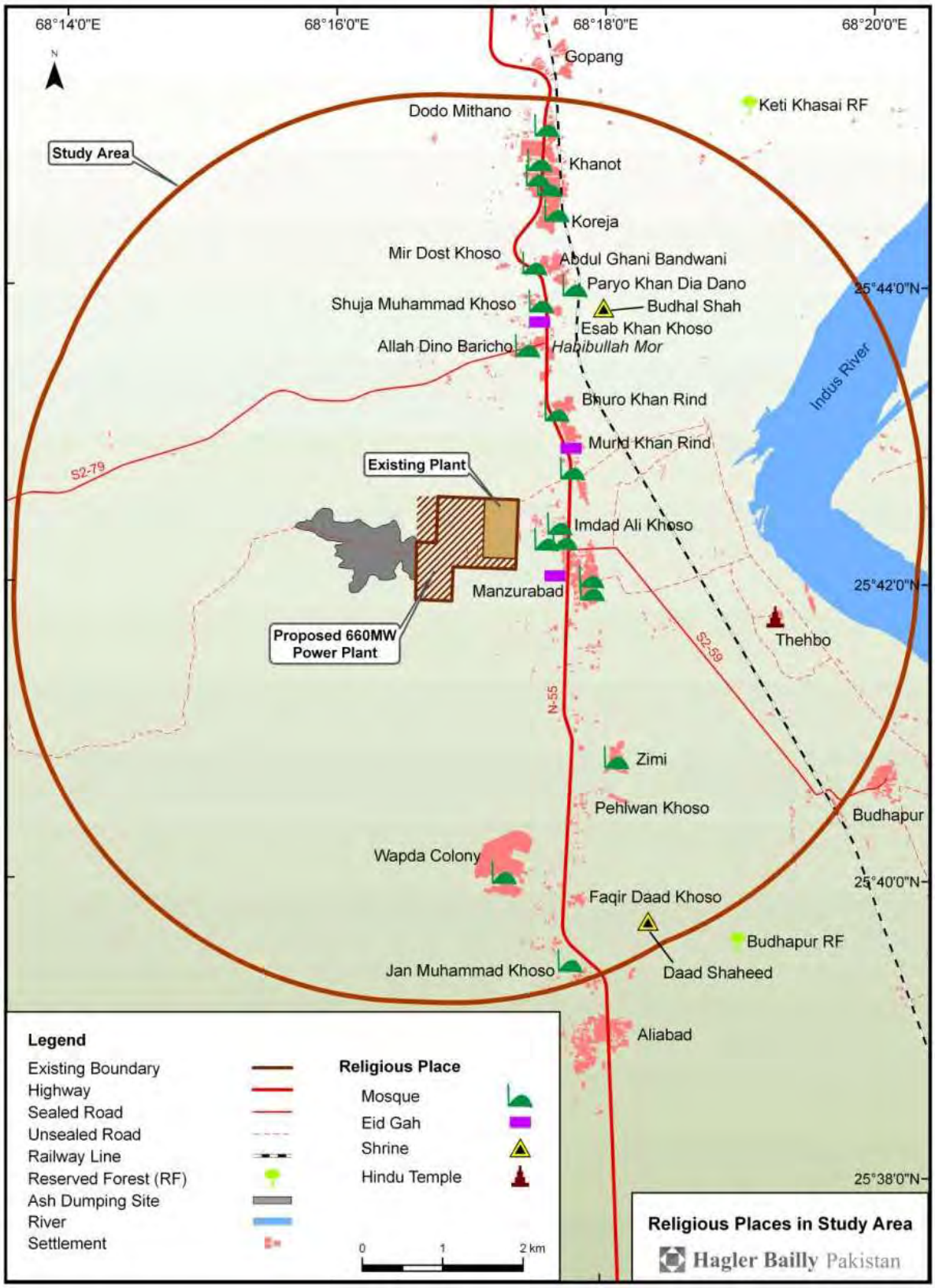
Sensitive Receptors



Source: Hagler Bailly Pakistan

Figure 2: Location of Sensitive Receptors – Educational Facilities

Sensitive Receptors



Source: Hagler Bailly Pakistan

Figure 3: Location of Sensitive Receptors – Religious Facilities

11 - 6 AMBIENT AIR QUALITY IMPACT OF IMPORTED COAL

Ambient Air Quality Impact of Imported Coal

Model was run for two scenarios.

Scenario 1 assumes that the power plant will be fired using 80 % imported coal and 20 % Thar coal. **Scenario 2** assumes that the power plant will use 100 % imported coal.

Scenario 1 (80 % imported coal and 20 % Thar coal)

Table 1 summarizes the air quality modeling results for the simulations. Concentration levels in ambient air were predicted for SO_2, NO_2, PM_{10}, and $PM_{2.5}$ for the simulations, whereas; Figure 1 through Figure 8 show the contour maps for the increment in pollutants concentration caused by the proposed Project for **Scenario 1**. Figure 9 through Figure 16 show the contour maps for the predicted ambient air quality after the proposed plant is commissioned and existing Lakhra Plant is rehabilitated for **Scenario 1**.

For SO_2, NO_2, PM_{10}, and $PM_{2.5}$ the maximum concentration levels were modeled for 24-hour averaging period and annual averaging period to correspond with the SEQS requirements. The maximum value is the highest concentration reached for a particular averaging period based on 3 years meteorological data. The 98^{th} percentile value shows the highest concentration 98% of the time in a year, which is found by eliminating 2% of the highest values as per the standards.

Ambient Air Quality Impact of Imported Coal

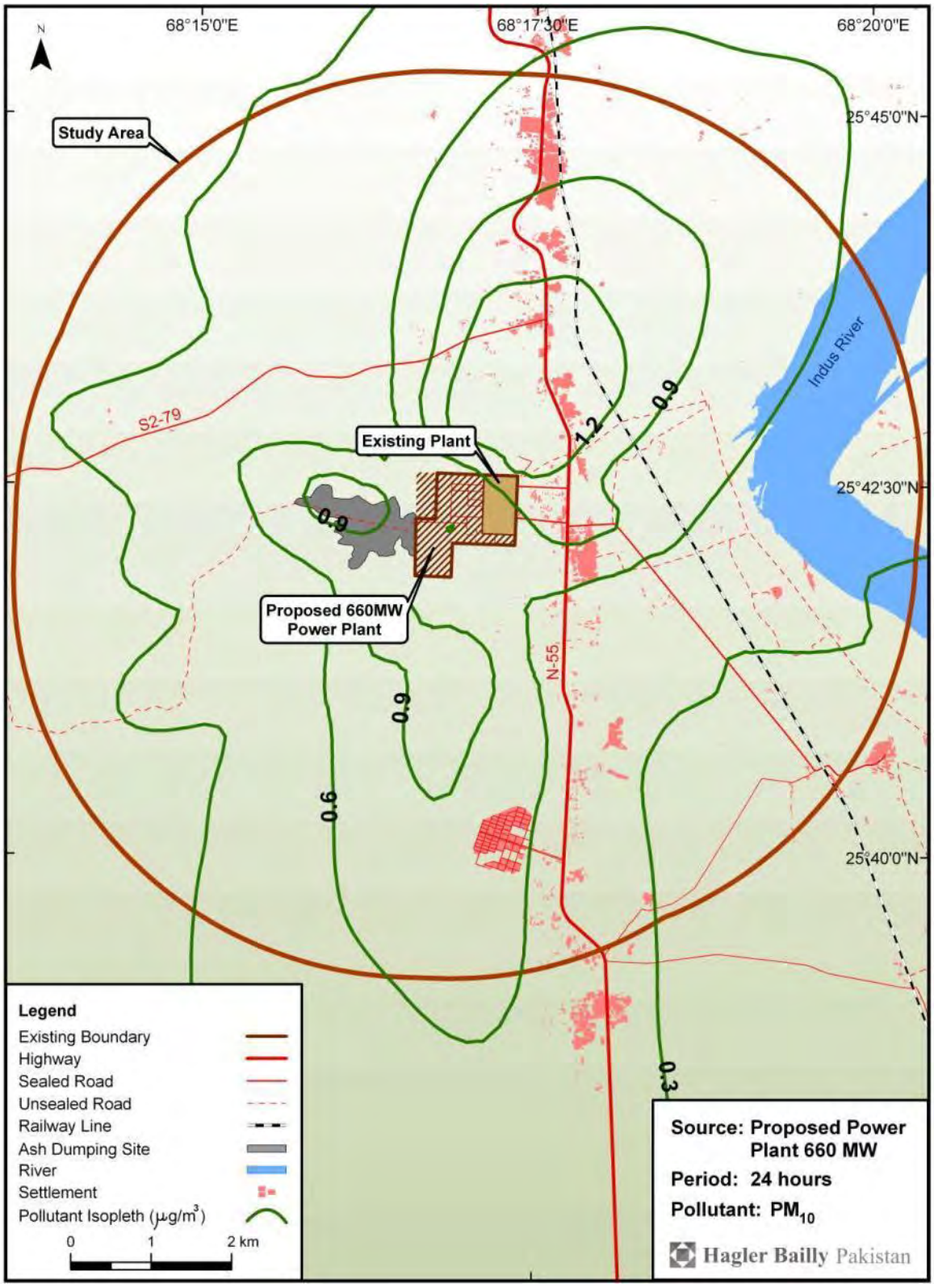
Table 1: Air Quality Modeling Results (µg/m³) for Scenario 1 and 2

Pollutant	Period	SEQS	IFC Guidelines	Estimated Background	Predicted Increment due to Proposed Plant (660 MW)		Predicted Ambient Air Quality After Proposed Plant Commissioning and LFPS Rehabilitation[1]	
					Scenario 1 80% Imported Coal; 20% Thar Coal	Scenario 2 100% Imported Coal	Scenario 1 80% Imported Coal; 20% Thar Coal	Scenario 2 100% Imported Coal
SO_2	Maximum 24–hr	–	125	10.8	7.7	7.1	120.9	120.5
	24–hr (98th %le)	120	–		7.3	6.7	88.1	87.8
	Annual	80	–		1.9	1.8	38.4	38.2
NO_2	Maximum 24–hr	–	200	21.1	6.2	6.1	86.6	86.5
	24–hr (98th %le)	80	–		5.8	5.8	67.3	67.2
	Annual	40	40		1.5	1.5	37.6	37.4
PM_{10}	Maximum 24–hr	–	150	69.1	1.5	1.5	75.9	75.9
	24–hr (98th %le)	150	–		1.5	1.4	73.8	73.8
	Annual	120	70		0.4	0.4	69.1	69.1
$PM_{2.5}$	Maximum 24–hr		75	43.1	0.7	0.7	46.5	46.5
	24–hr (98th %le)	75	–		0.7	0.7	45.5	45.5
	Annual	40 or back-ground plus 9	35		0.2	0.2	43.9	43.9

Source: Hagler Bailly Pakistan

[1] Includes emission from the Proposed Plant, the existing plant with 150 MW capacity after rehabilitation and the background concentration of the pollutants.

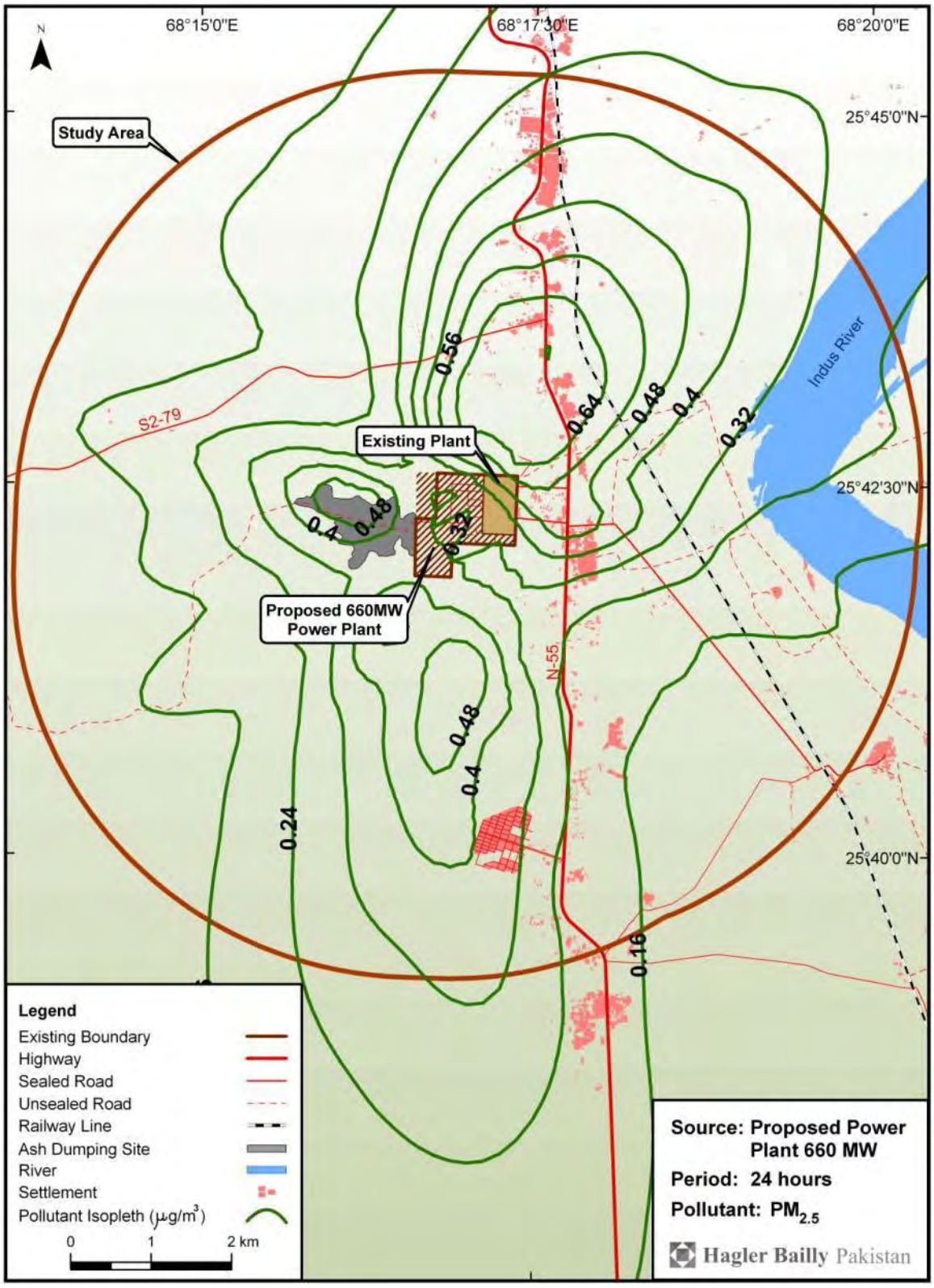
Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

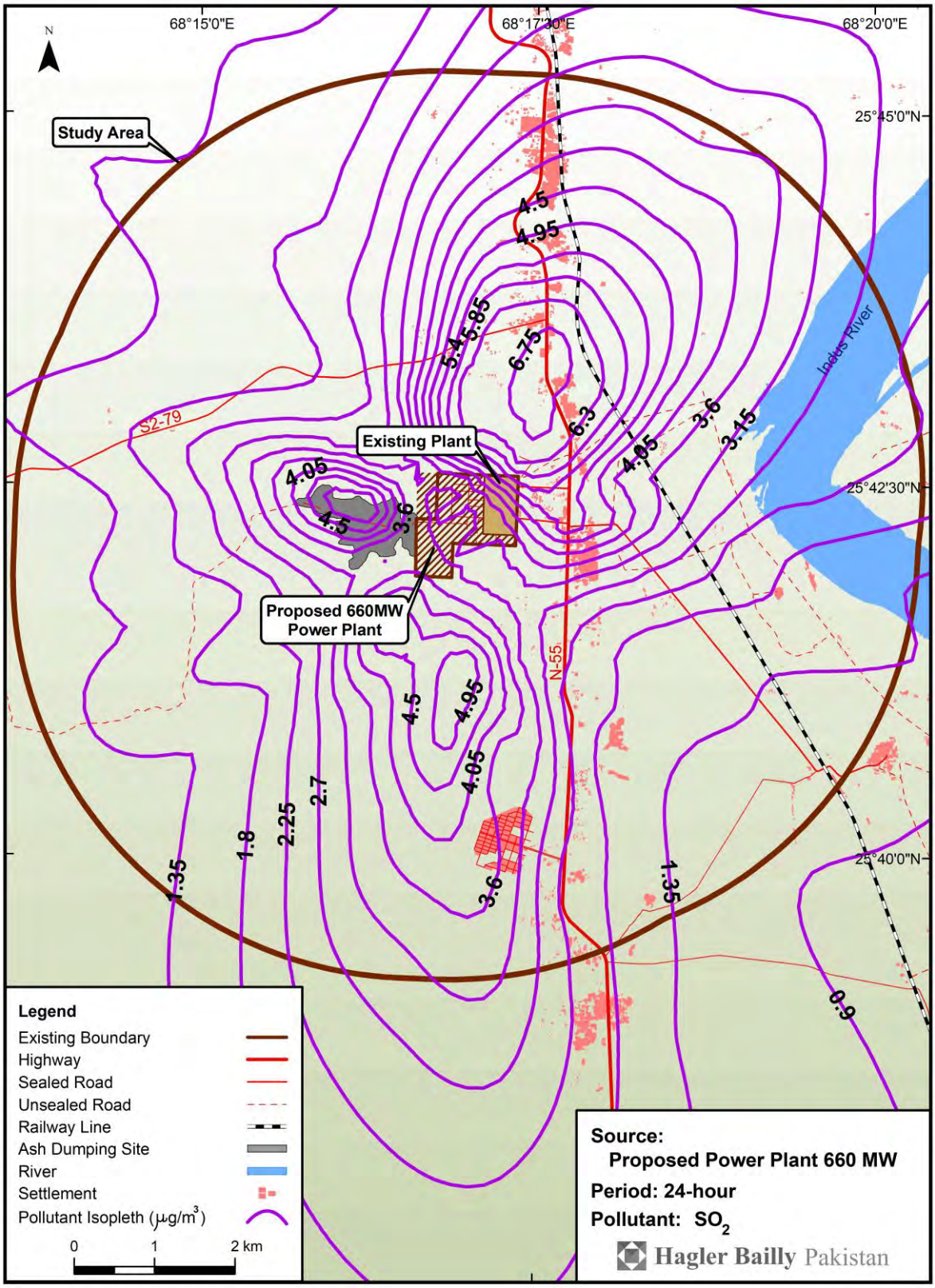
Figure 1: Predicted Increment to the 24–hour PM_{10} Levels Caused by the Proposed Plant (Scenario 1)

Ambient Air Quality Impact of Imported Coal



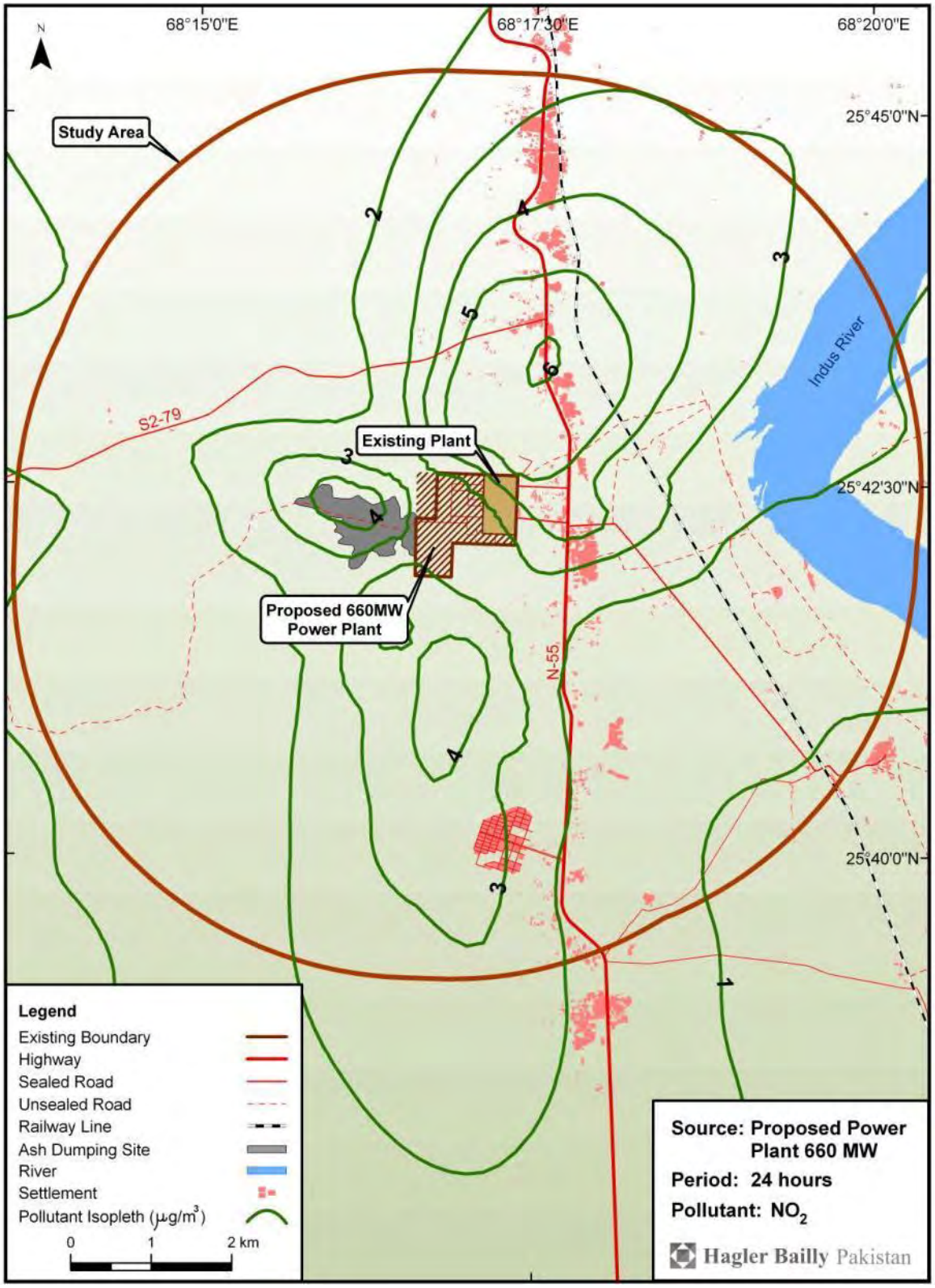
Source: Hagler Bailly Pakistan

Figure 2: Predicted Increment to the 24–hour $PM_{2.5}$ Levels Caused by the Proposed Plant (Scenario 1)



Source: Hagler Bailly Pakistan

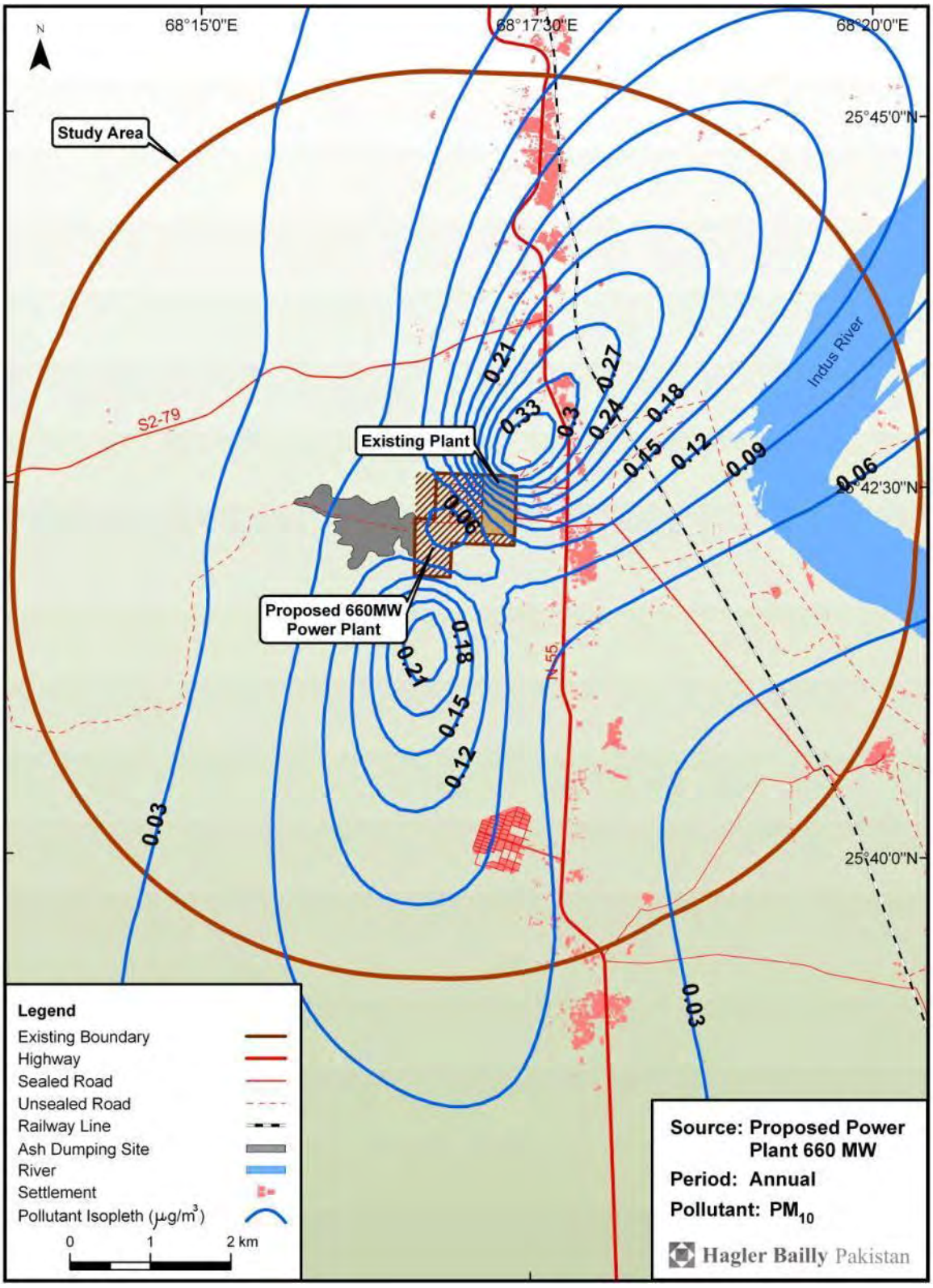
Figure 3: Predicted Increment to the 24–hour SO_2 Levels Caused by the Proposed Plant (Scenario 1)



Source: Hagler Bailly Pakistan

Figure 4: Predicted Increment to the 24–hour NO_2 Levels Caused by the Proposed Plant (Scenario 1)

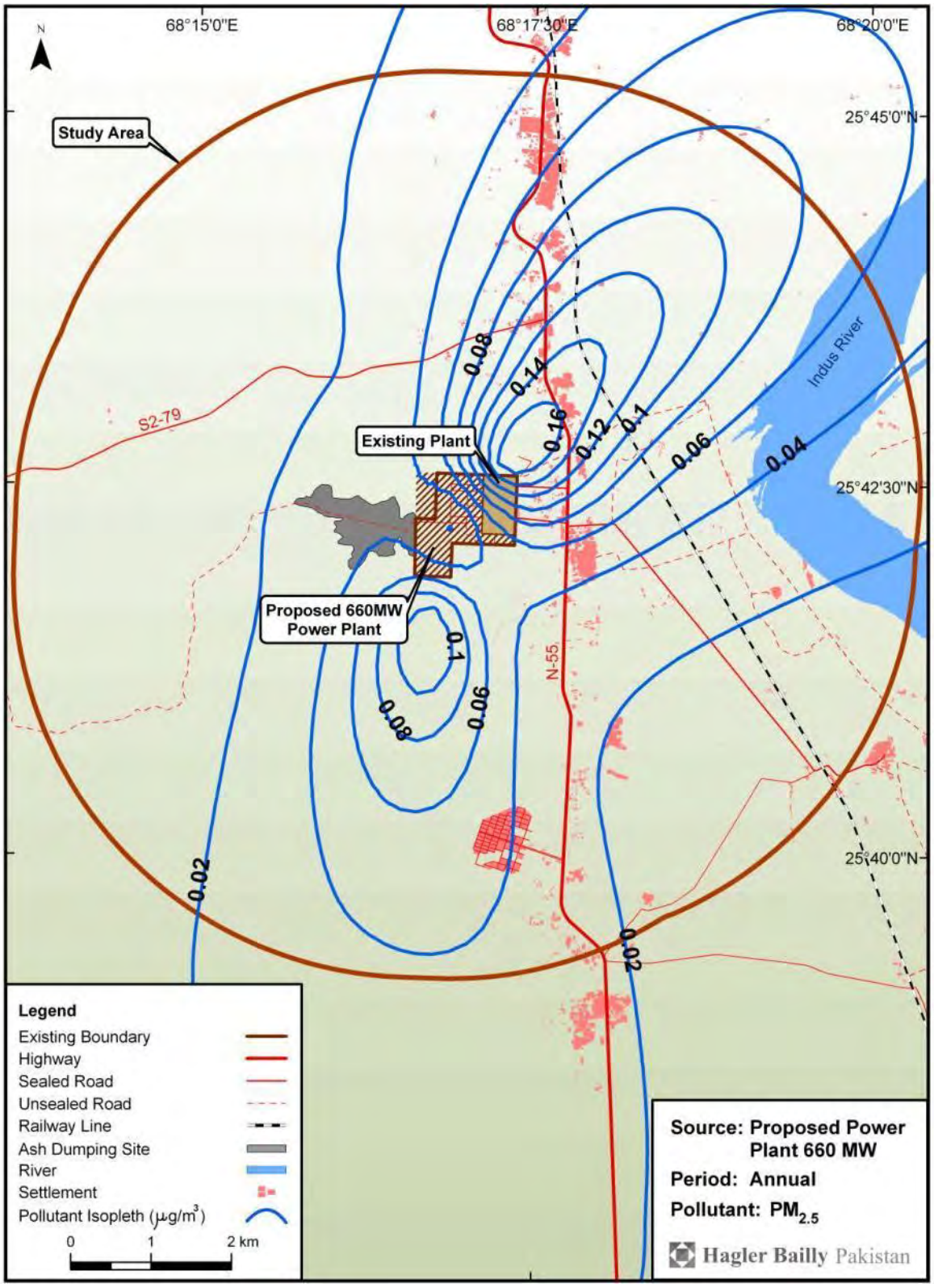
Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

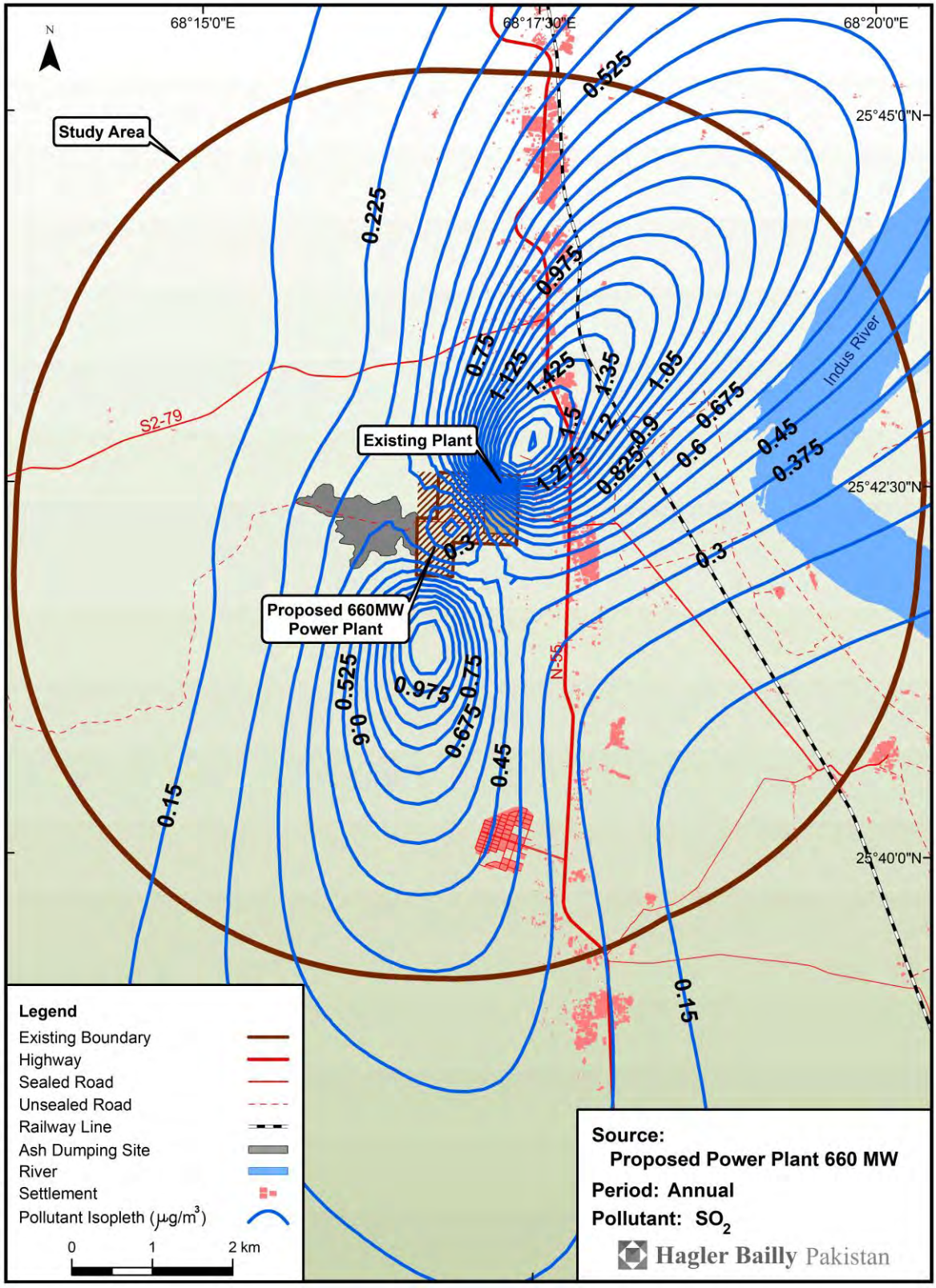
Figure 5: Predicted Increment to the Annual PM_{10} Levels Caused by the Proposed Plant (Scenario 1)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

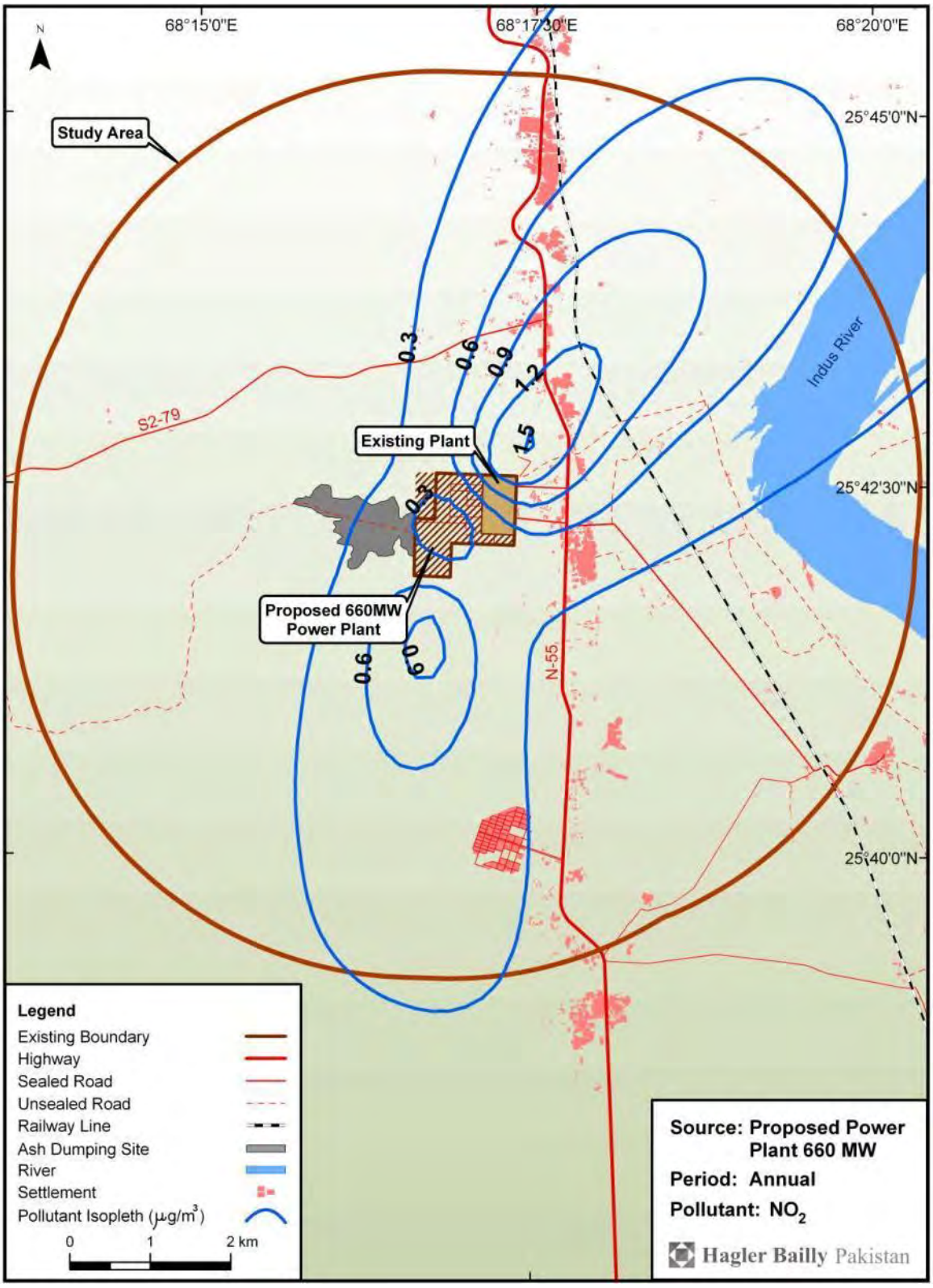
Figure 6: Predicted Increment to the Annual $PM_{2.5}$ Levels Caused by the Proposed Plant (Scenario 1)



Source: Hagler Bailly Pakistan

Figure 7: Predicted Increment to the Annual SO_2 Levels Caused by the Proposed Plant (Scenario 1)

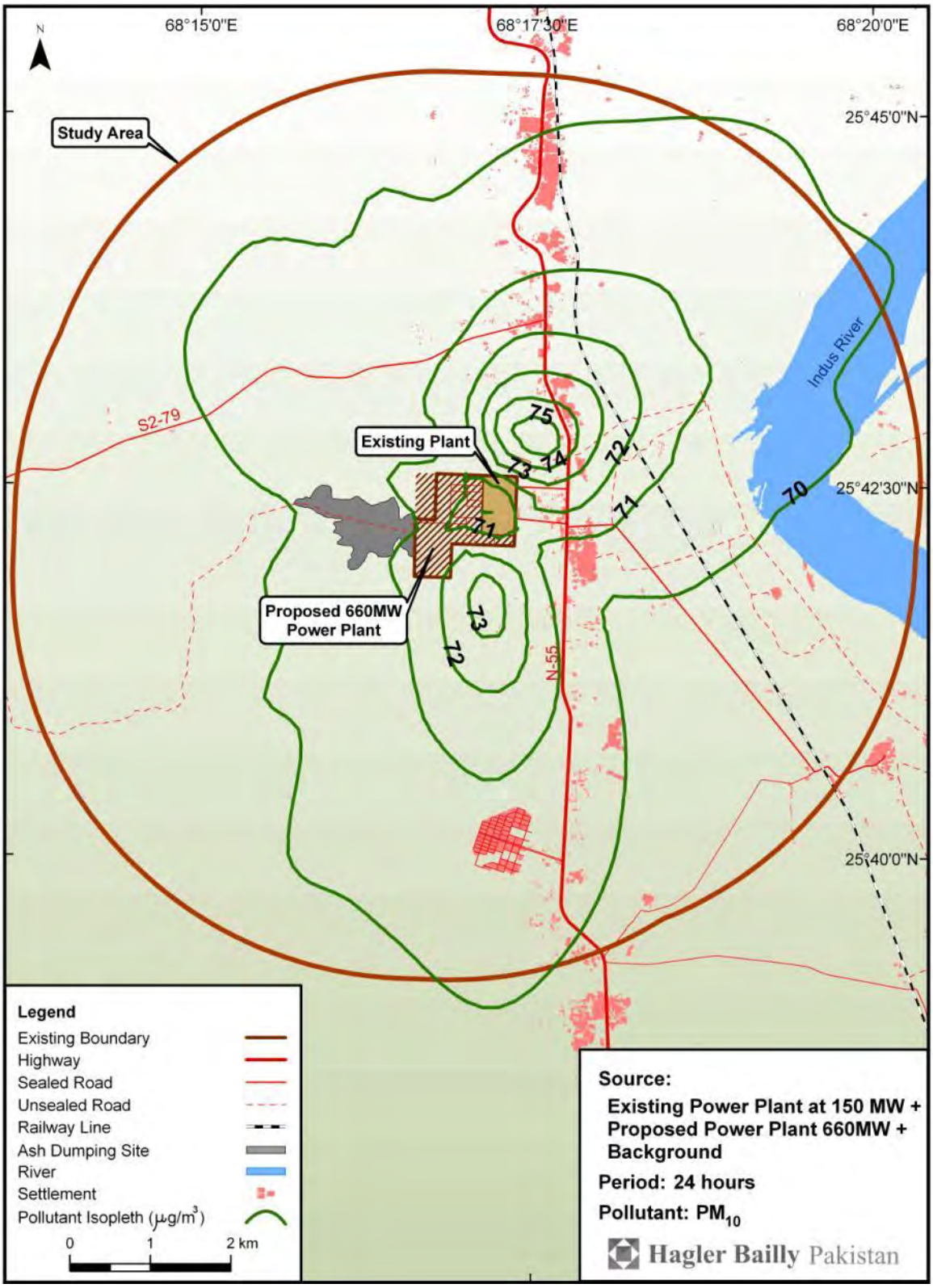
Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

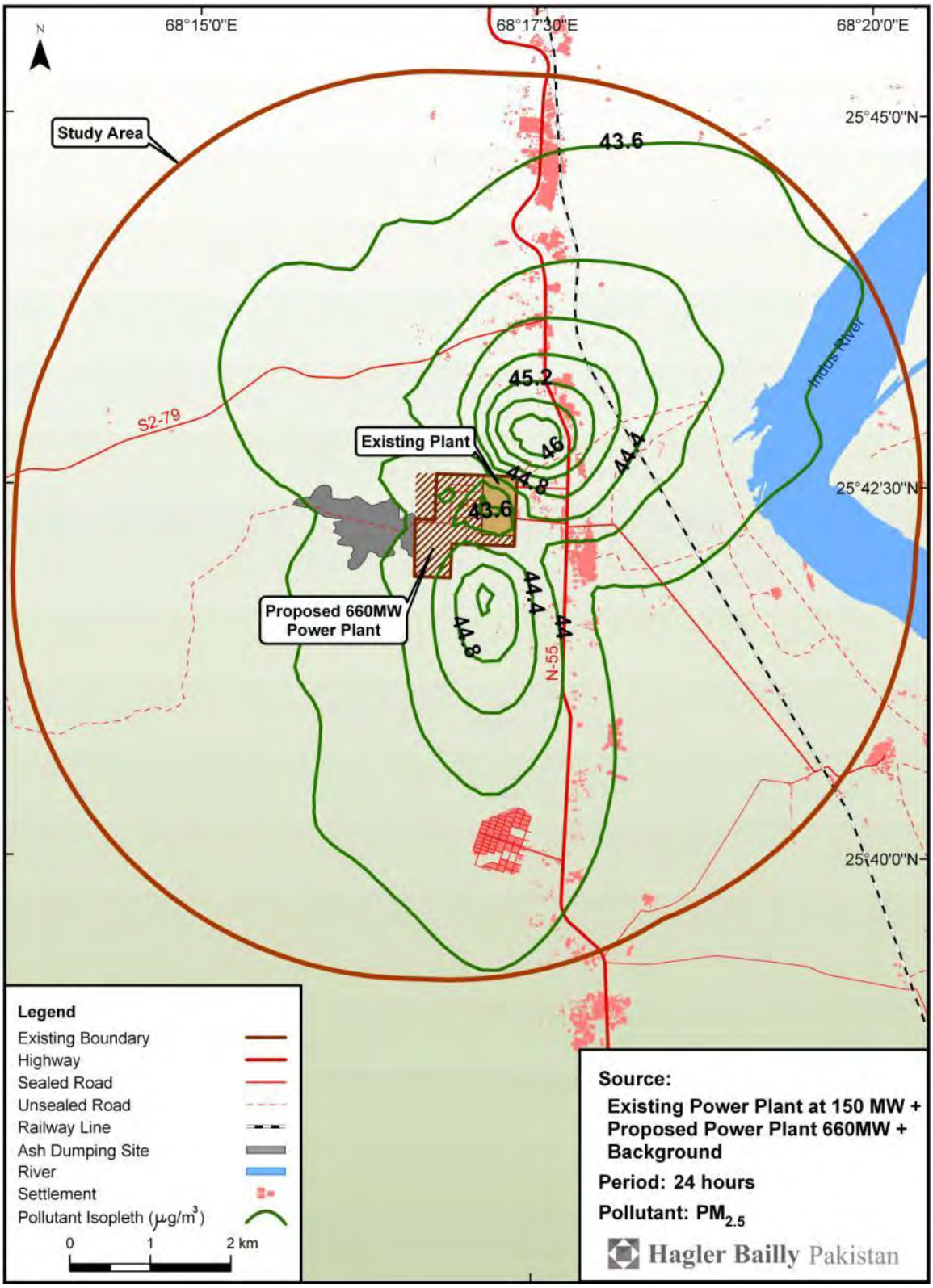
Figure 8: Predicted Increment to the Annual NO_2 Levels Caused by the Proposed Plant (Scenario 1)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

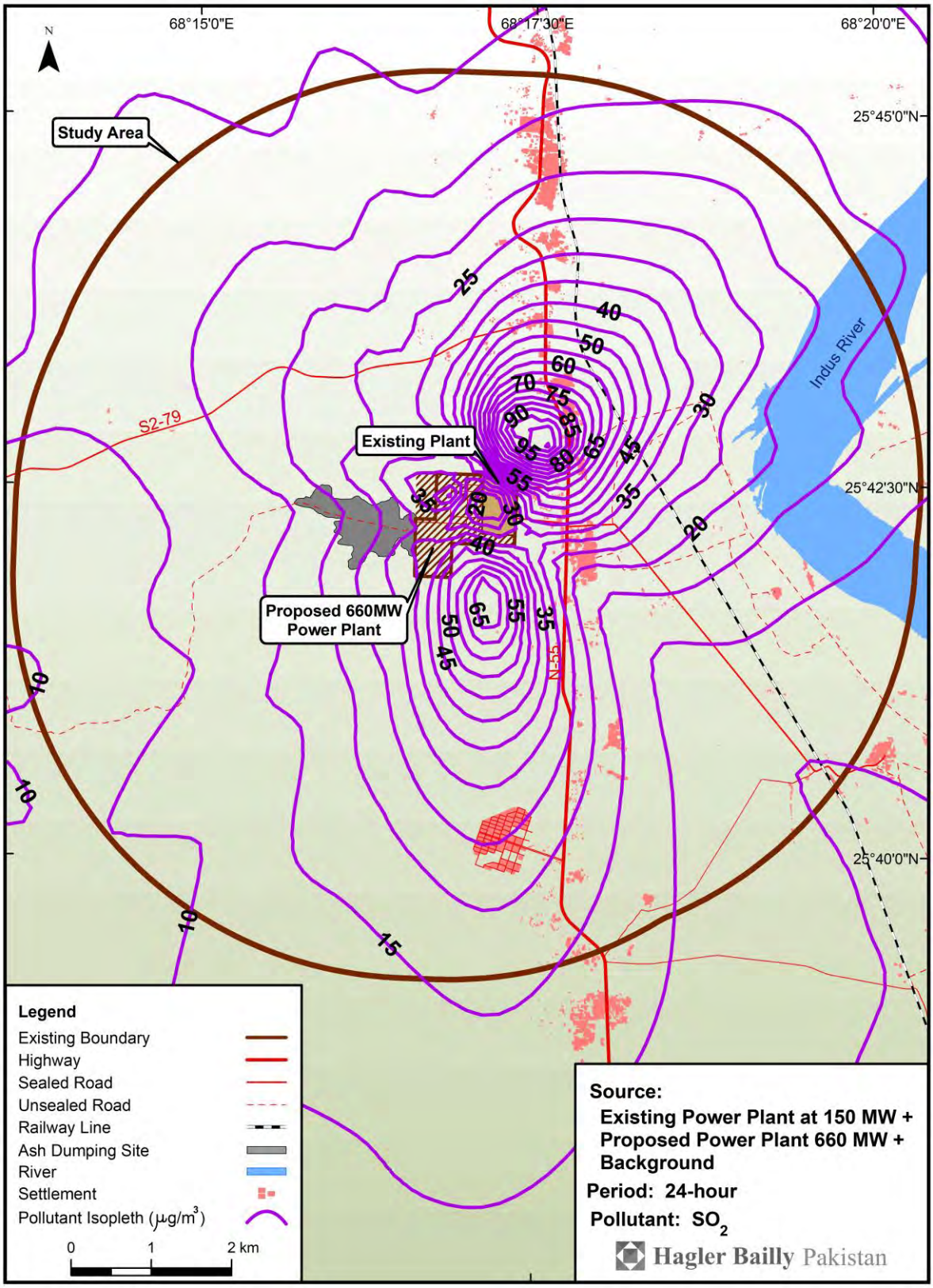
Figure 9: Combined 24–hour PM_{10} Levels (Scenario 1)



Source: Hagler Bailly Pakistan

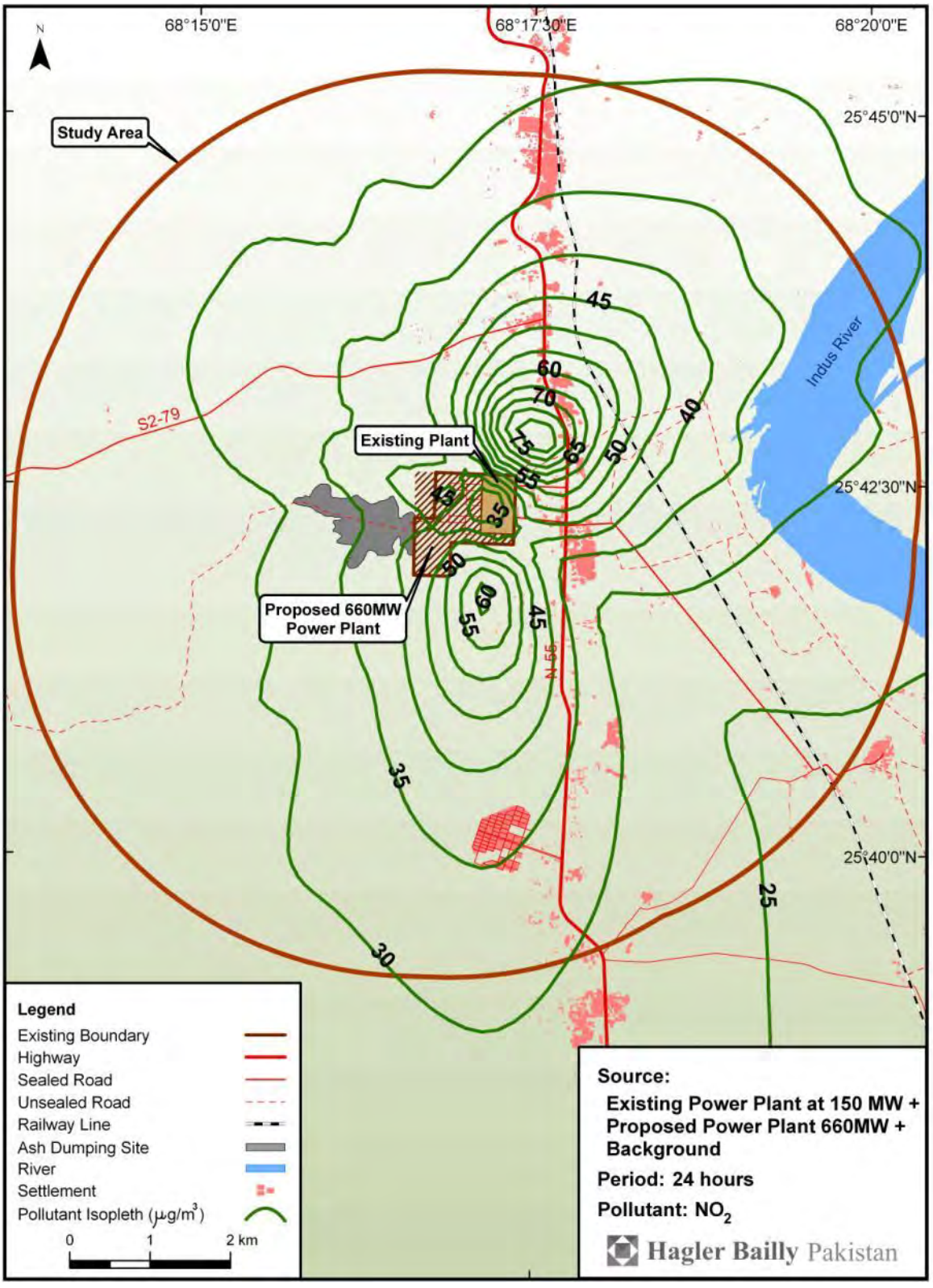
Figure 10: Combined 24–hour $PM_{2.5}$ Levels (Scenario 1)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

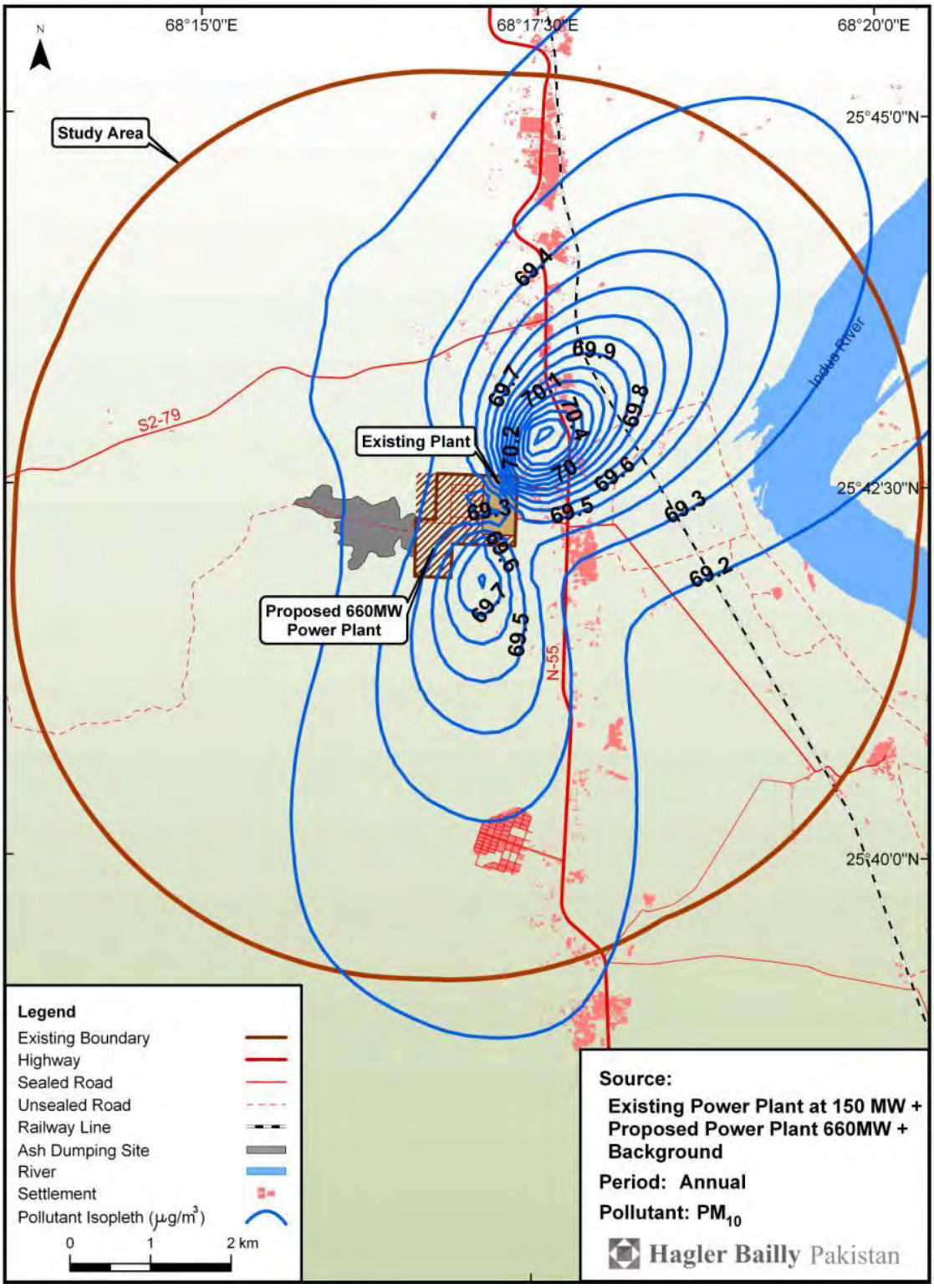
Figure 11: Combined 24–hour SO_2 Levels (Scenario 1)



Source: Hagler Bailly Pakistan

Figure 12: Combined 24–hour NO_2 Levels (Scenario 1)

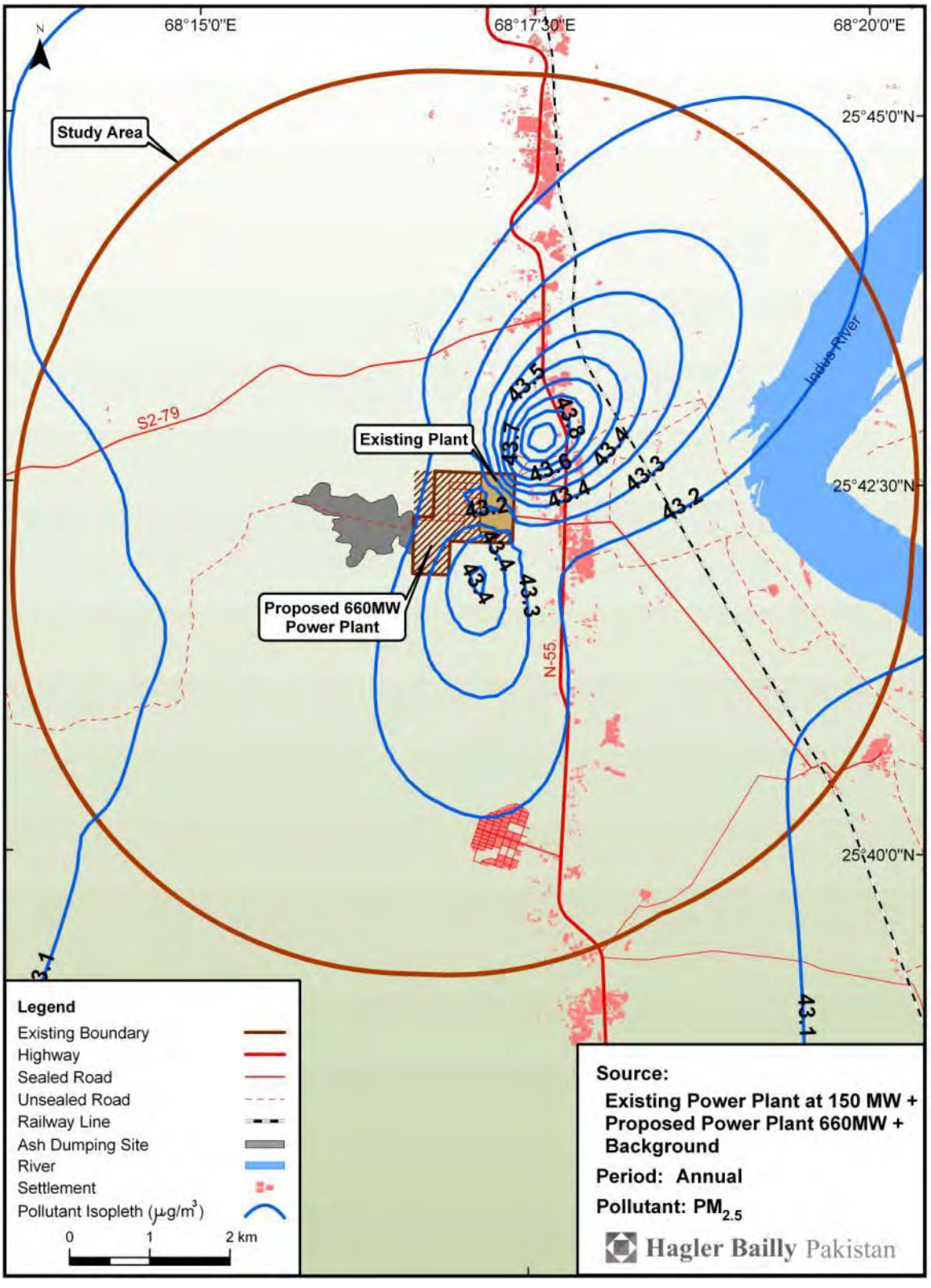
Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

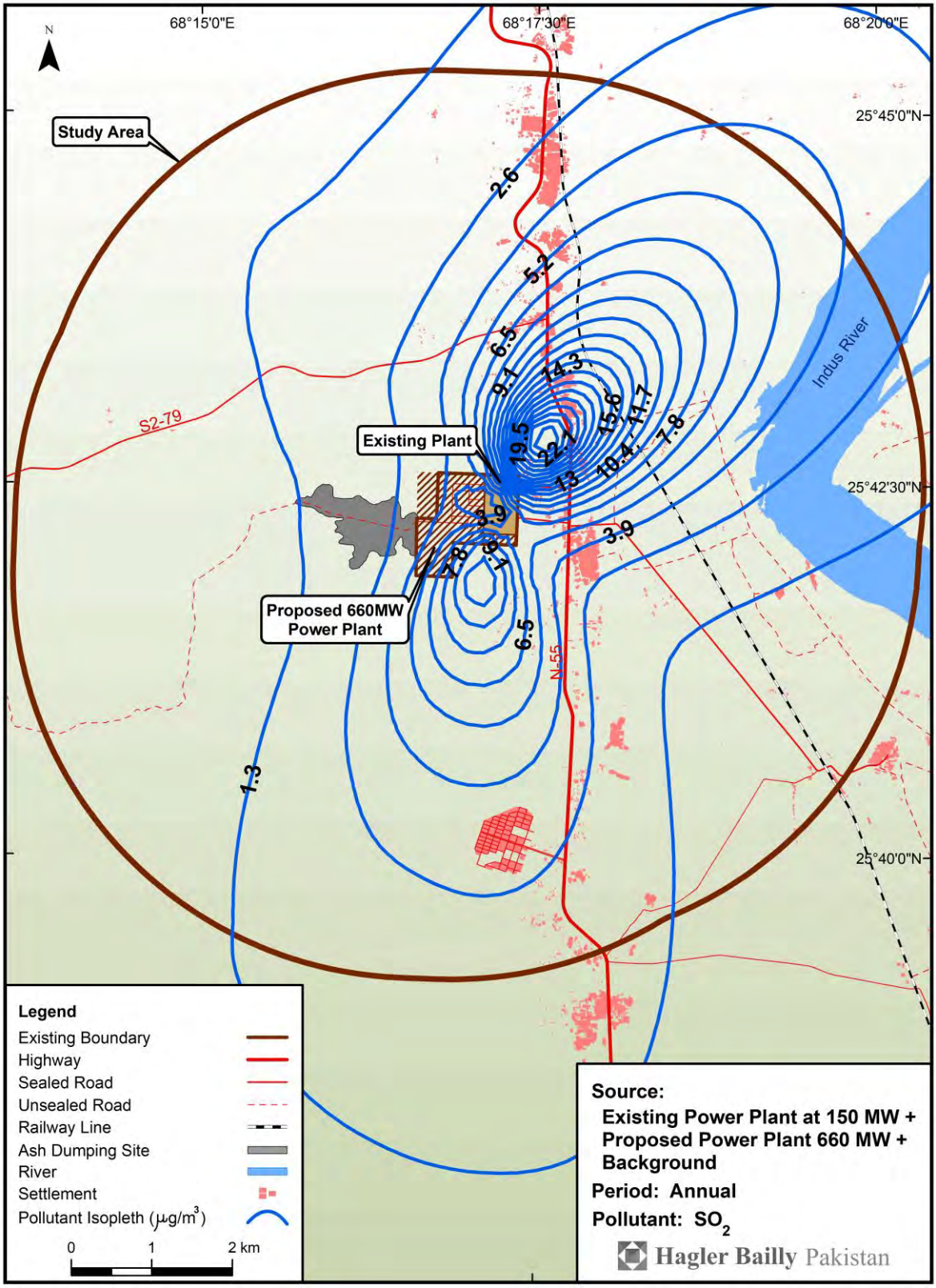
Figure 13: Combined Annual PM_{10} Levels (Scenario 1)

Ambient Air Quality Impact of Imported Coal



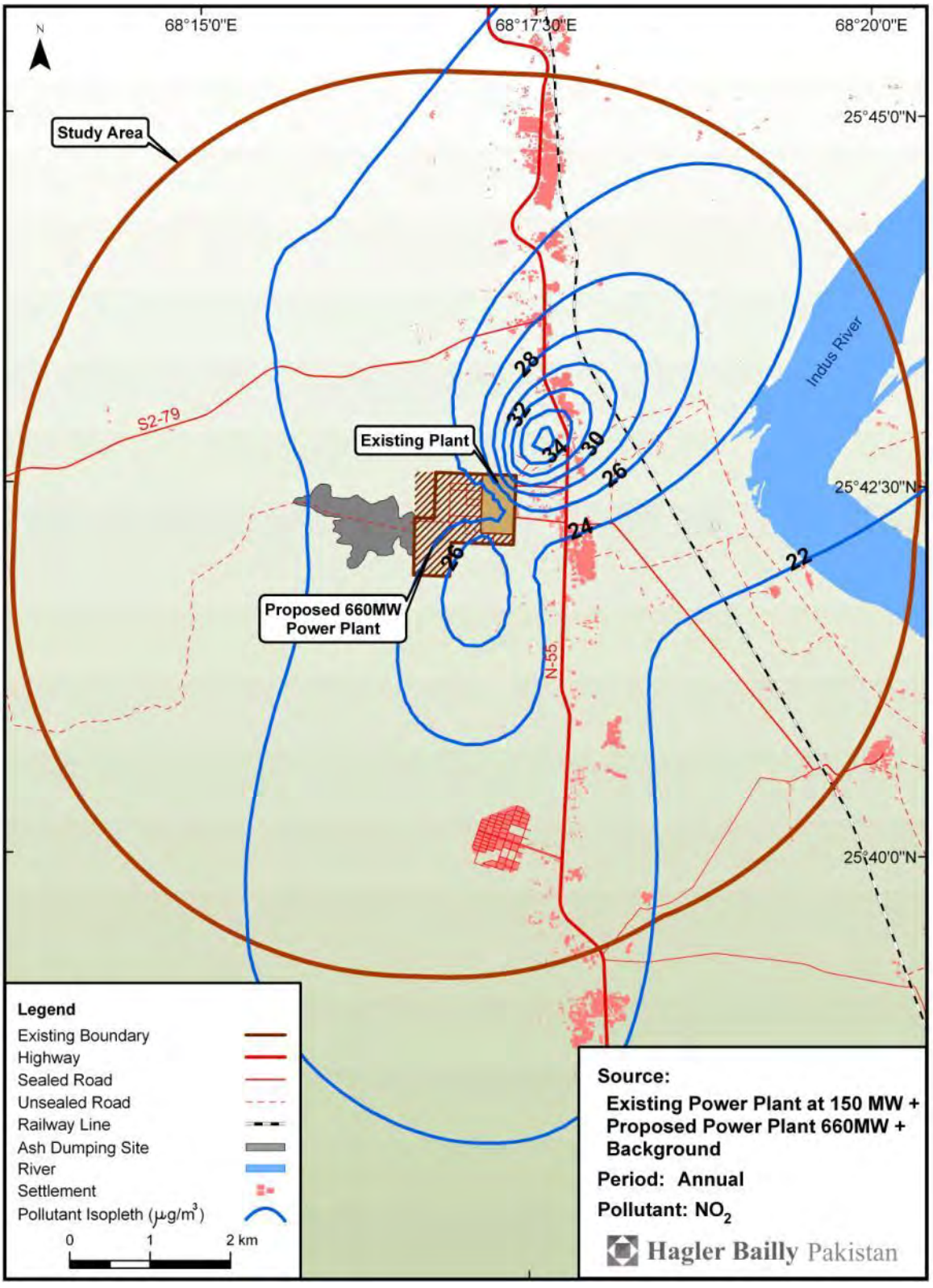
Source: Hagler Bailly Pakistan

Figure 14: Combined Annual $PM_{2.5}$ Levels (Scenario 1)



Source: Hagler Bailly Pakistan

Figure 15: Combined Annual SO_2 Levels (Scenario 1)



Source: Hagler Bailly Pakistan

Figure 16: Combined Annual NO_2 Levels (Scenario 1)

Ambient Air Quality Impact of Imported Coal

Scenario 2 (100 % imported coal)

Air modeling was undertaken assuming that the power plant will use 100 % imported coal. This appendix summarizes the input data and results for this scenario (**Scenario 2**).

Emissions Sources and Modeling Parameters

Table 2 shows the modeling parameters used in **Scenario 2**.

Table 2: Air Quality Modeling Parameters Used

Parameter	Existing Power Plant (150 MW)	Proposed Power Plant (660 MW)
Fuel	Lakhra Coal	Imported coal 100%
Load Factor	80%	80%
Gross Capacity, MW	150	660
Stack Height, m	100	210
Inner Dia, m	4.5	6.4
Flue Gas Temperature, K	430	430
Exit Velocity, m/s	14.1	20
SO_2, g/s	282.7	61.0
PM_{10}, g/s	17.8	12.1
$PM_{2.5}$ g/s	8.9	6.6
NO_2, g/s	164.7	103.4

Source: Hagler Bailly Pakistan

Air Quality Modeling Results

Table Table 3 summarizes the air quality modeling results for the simulations. Concentration levels in ambient air were predicted for SO_2, NO_2, PM_{10}, and $PM_{2.5}$ for the simulations, whereas; Figure 17 through Figure 24 show the contour maps for the increment in pollutants concentration caused by the proposed Project once commissioned using 100 % imported coal. Whereas Figure 25 through Figure 32 show the contour maps for the predicted ambient air quality after the proposed plant is commissioned using 100 % imported coal and existing Lakhra Plant is rehabilitated.

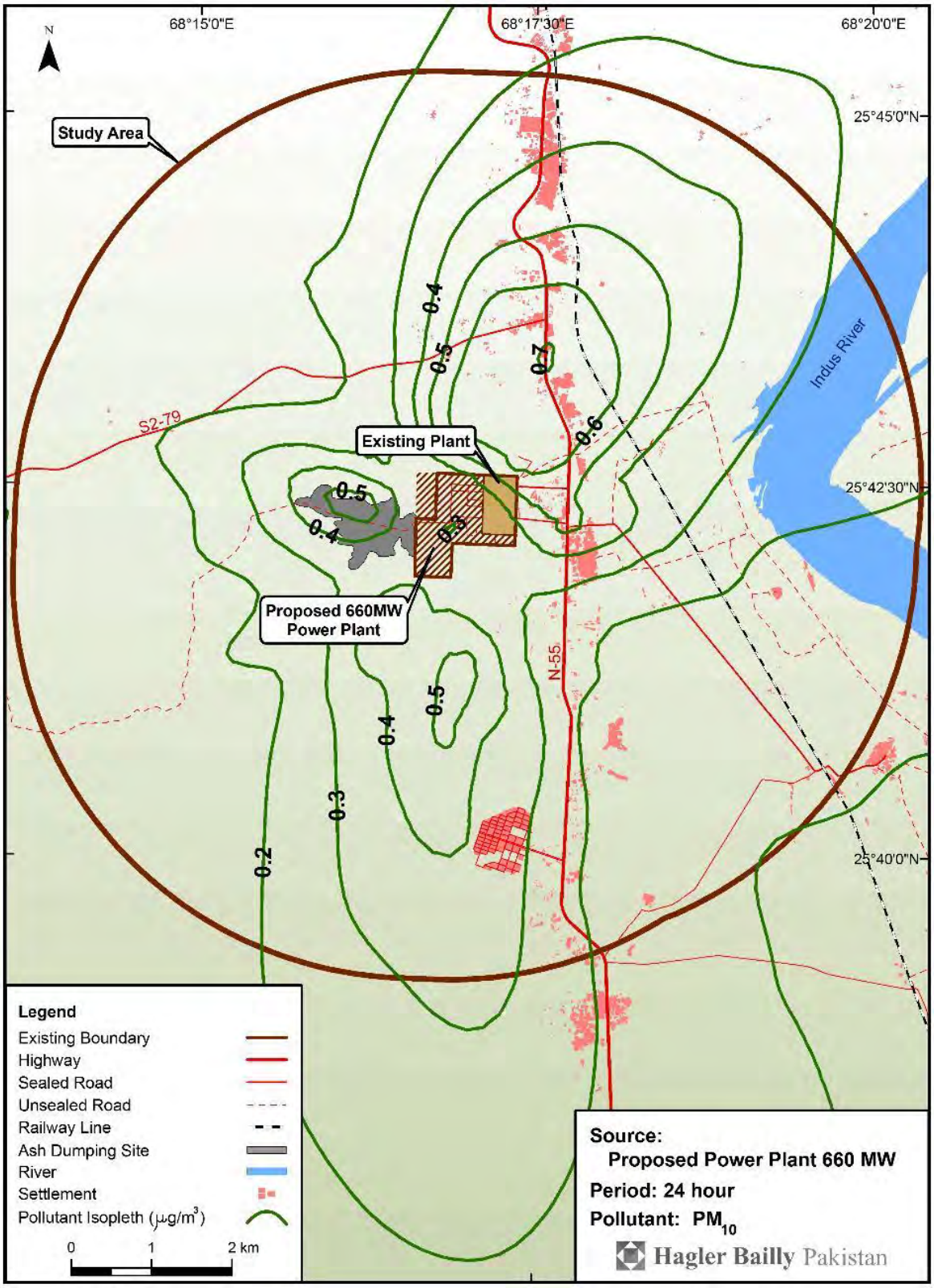
For SO_2, NO_2, PM_{10}, and $PM_{2.5}$ the maximum concentration levels were modeled for 24-hour averaging period and annual averaging period to correspond with the SEQS requirements. The maximum value is the highest concentration reached for a particular averaging period based on 3 years meteorological data. The 98^{th} percentile value shows the highest concentration 98% of the time in a year, which is found by eliminating 2% of the highest values as per the standards.

Table 3: Air Quality Modeling Results (µg/m³) for Scenario 2

	Period	SEQS	IFC Guide-lines	Estimated Background	Predicted Increment due to Proposed Plant (660 MW)	Predicted Ambient Air Quality After Proposed Plant Commissioning and LFPS Rehabilitation[2]
SO_2	Maximum 24–hr	–	125	10.8	7.1	120.5
	24–hr (98th %le)	120	–		6.7	87.8
	Annual	80	–		1.8	38.2
NO_2	Maximum 24–hr	–	200	21.1	6.1	86.5
	24–hr (98th %le)	80	–		5.8	67.2
	Annual	40	40		1.5	37.4
PM_{10}	Maximum 24–hr	–	150	69.1	1.5	75.9
	24–hr (98th %le)	150	–		1.4	73.8
	Annual	120	70		0.4	69.1
$PM_{2.5}$	Maximum 24–hr		75	43.1	0.8	46.5
	24–hr (98th %le)	75	–		0.7	45.5
	Annual	40 or back-ground plus 9	35		0.2	43.9

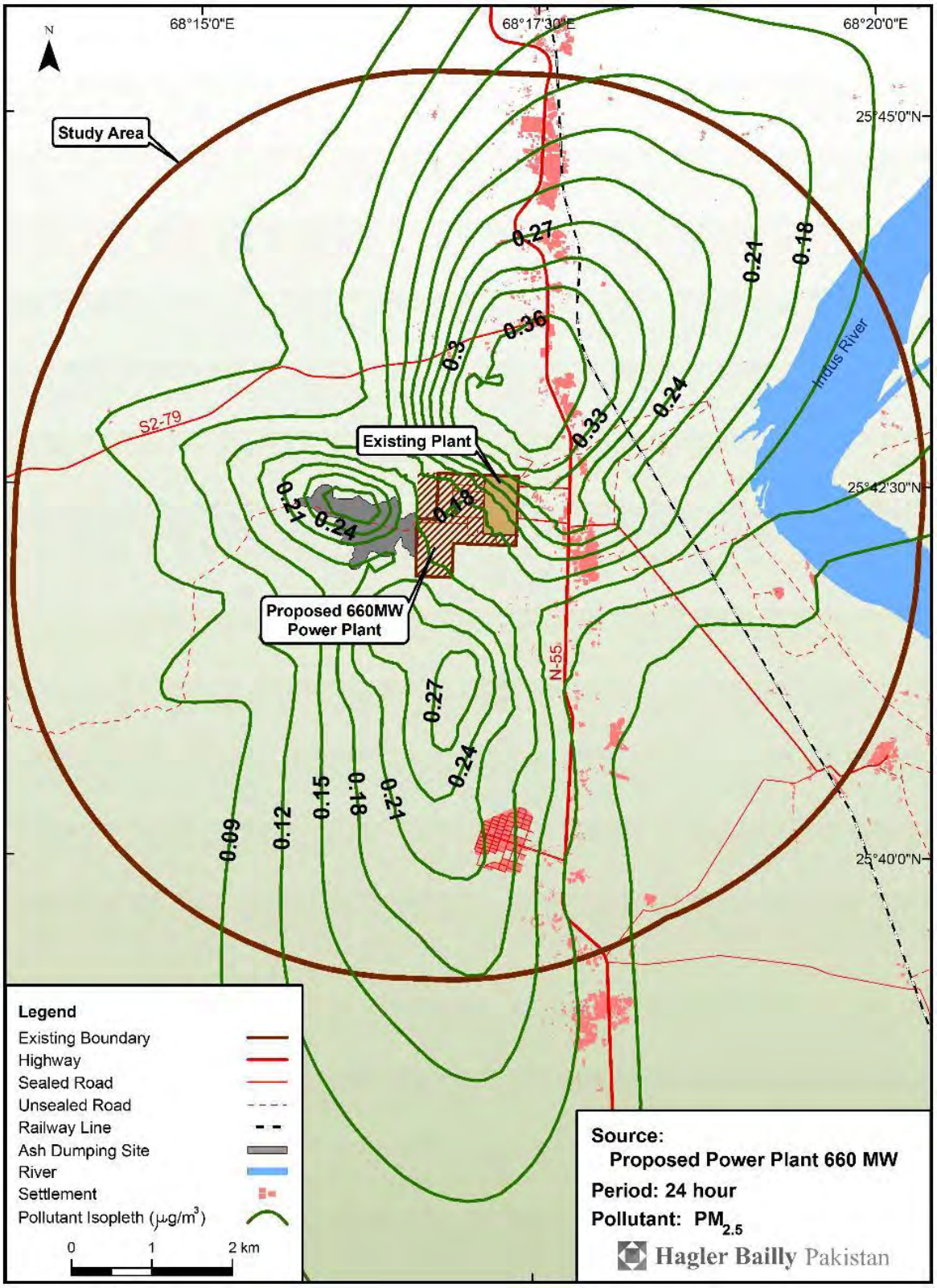
Source: Hagler Bailly Pakistan

[2] Includes emission from the Proposed Plant, the existing plant with 150 MW capacity after rehabilitation and the background concentration of the pollutants.



Source: Hagler Bailly Pakistan

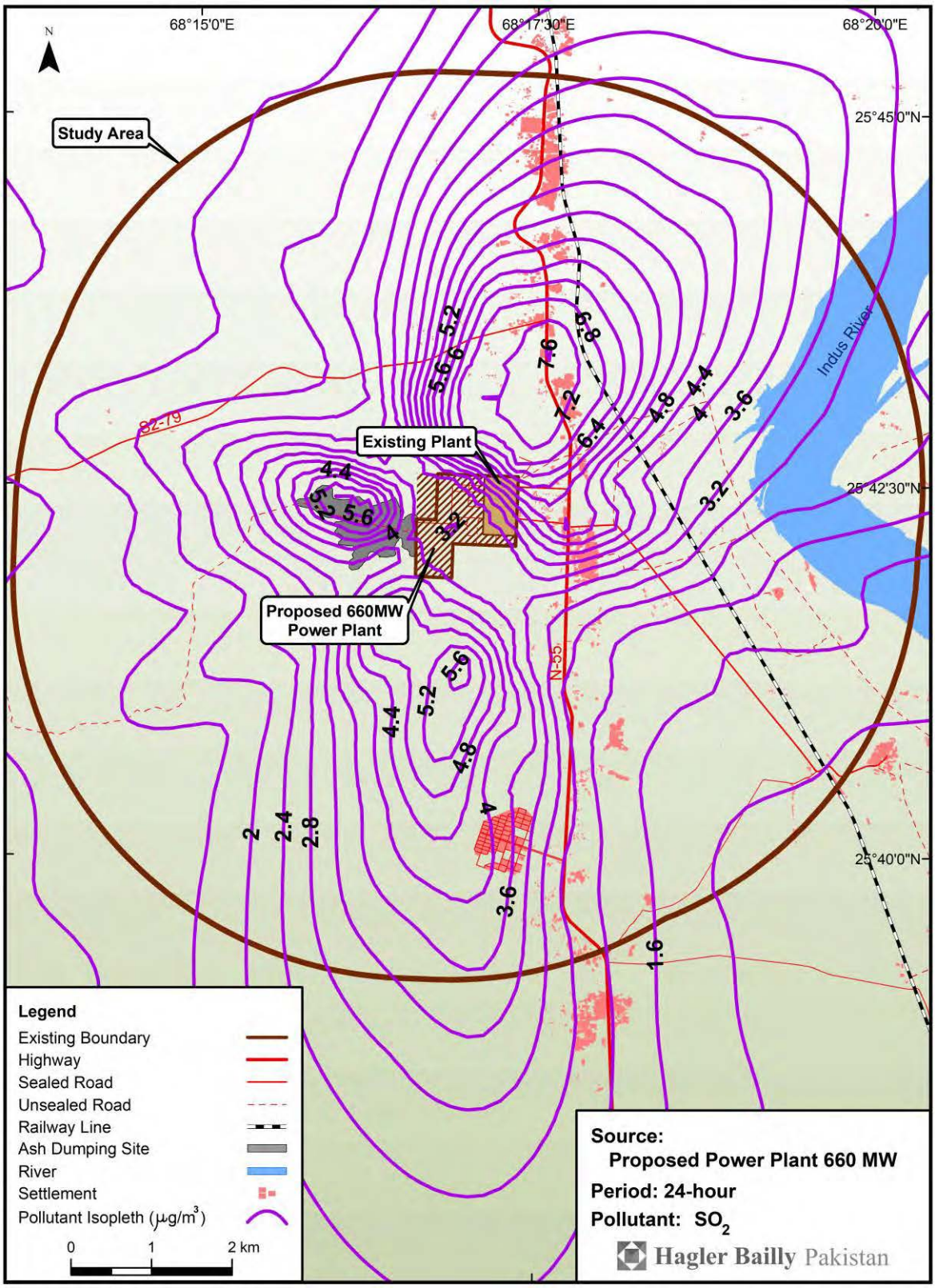
Figure 17: Predicted Increment to the 24–hour PM_{10} Levels Caused by the Proposed Plant (Scenario 2)



Source: Hagler Bailly Pakistan

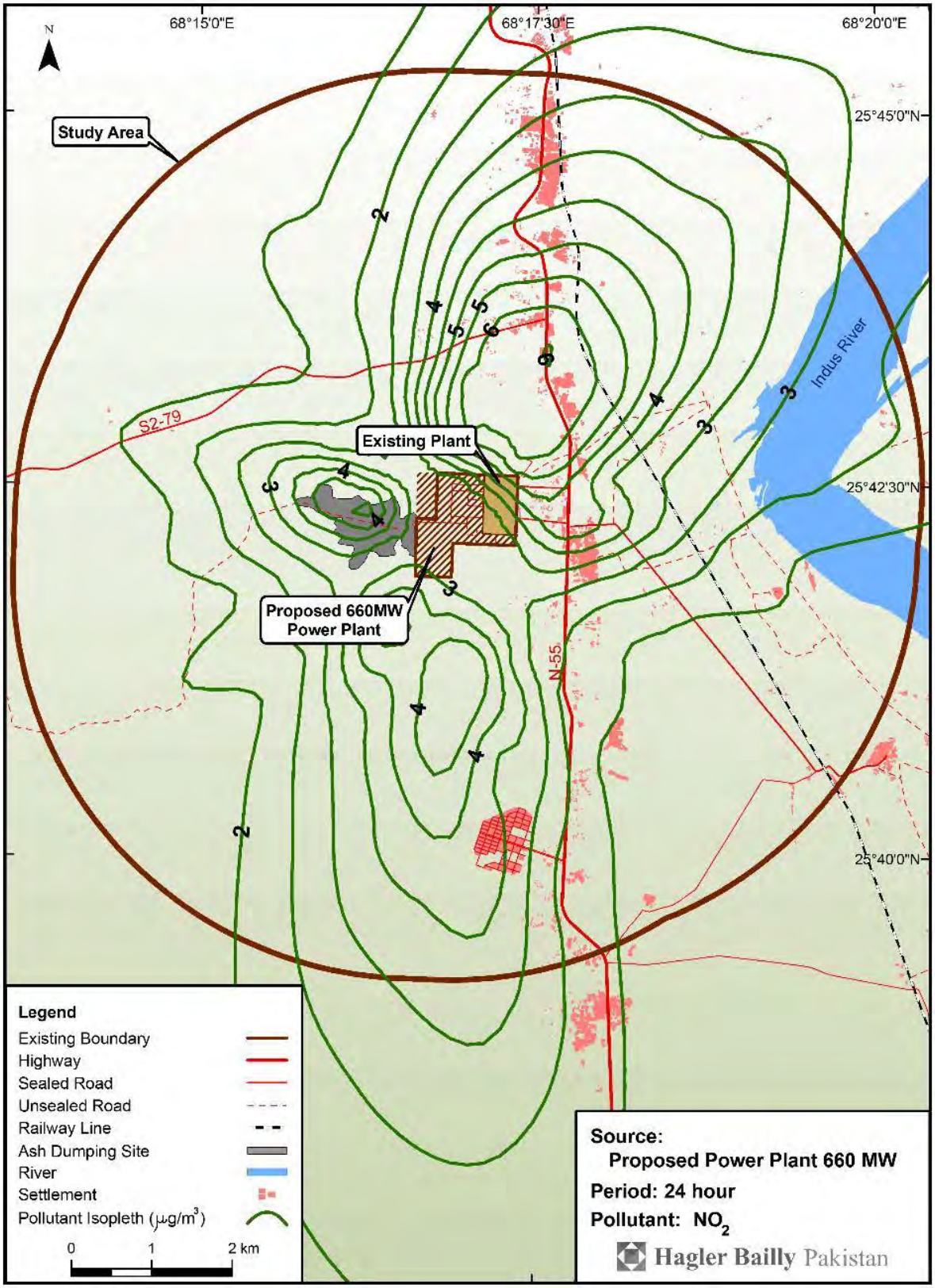
Figure 18: Predicted Increment to the 24–hour $PM_{2.5}$ Levels Caused by the Proposed Plant (Scenario 2)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

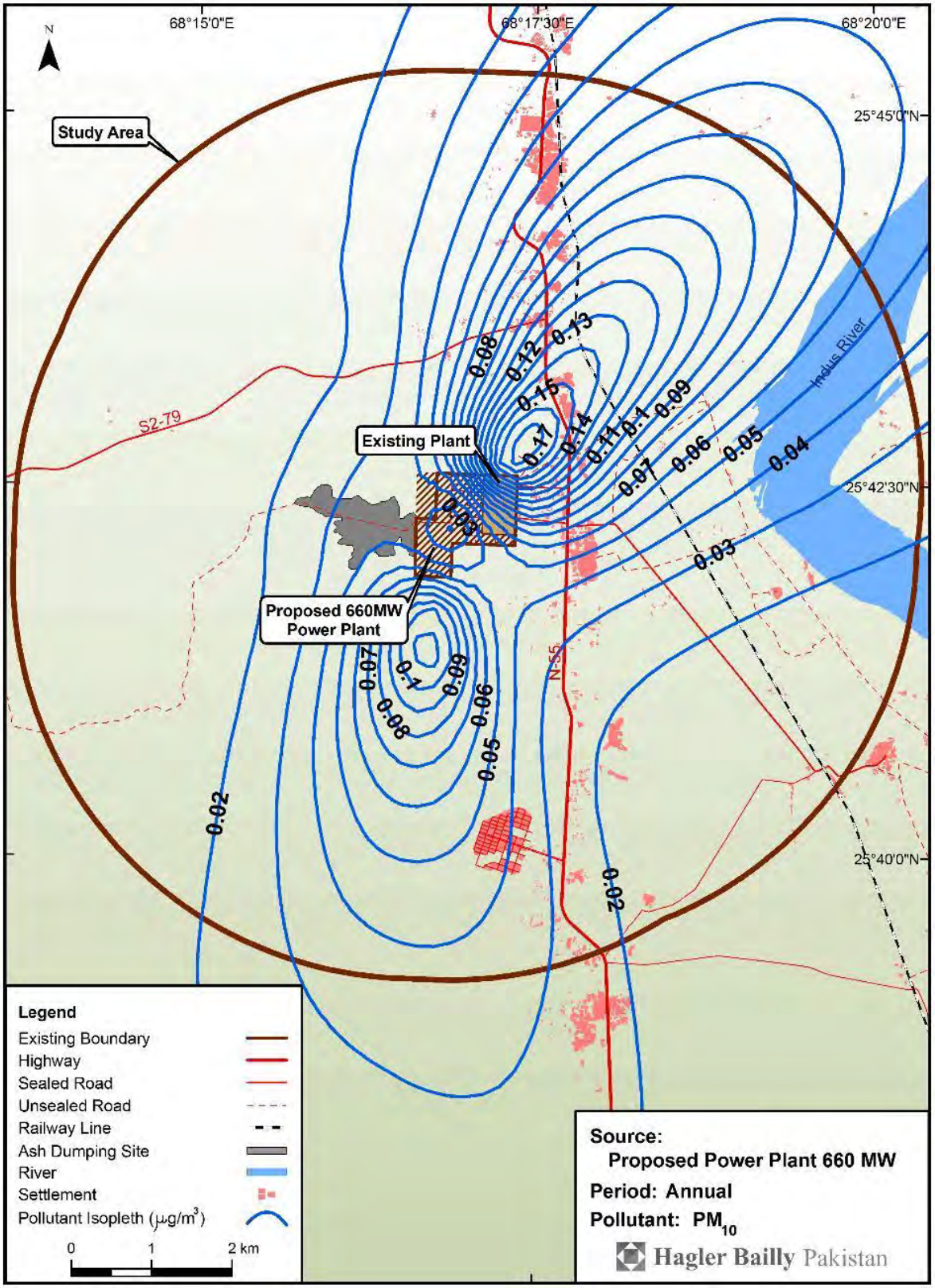
Figure 19: Predicted Increment to the 24–hour SO_2 Levels Caused by the Proposed Plant (Scenario 2)



Source: Hagler Bailly Pakistan

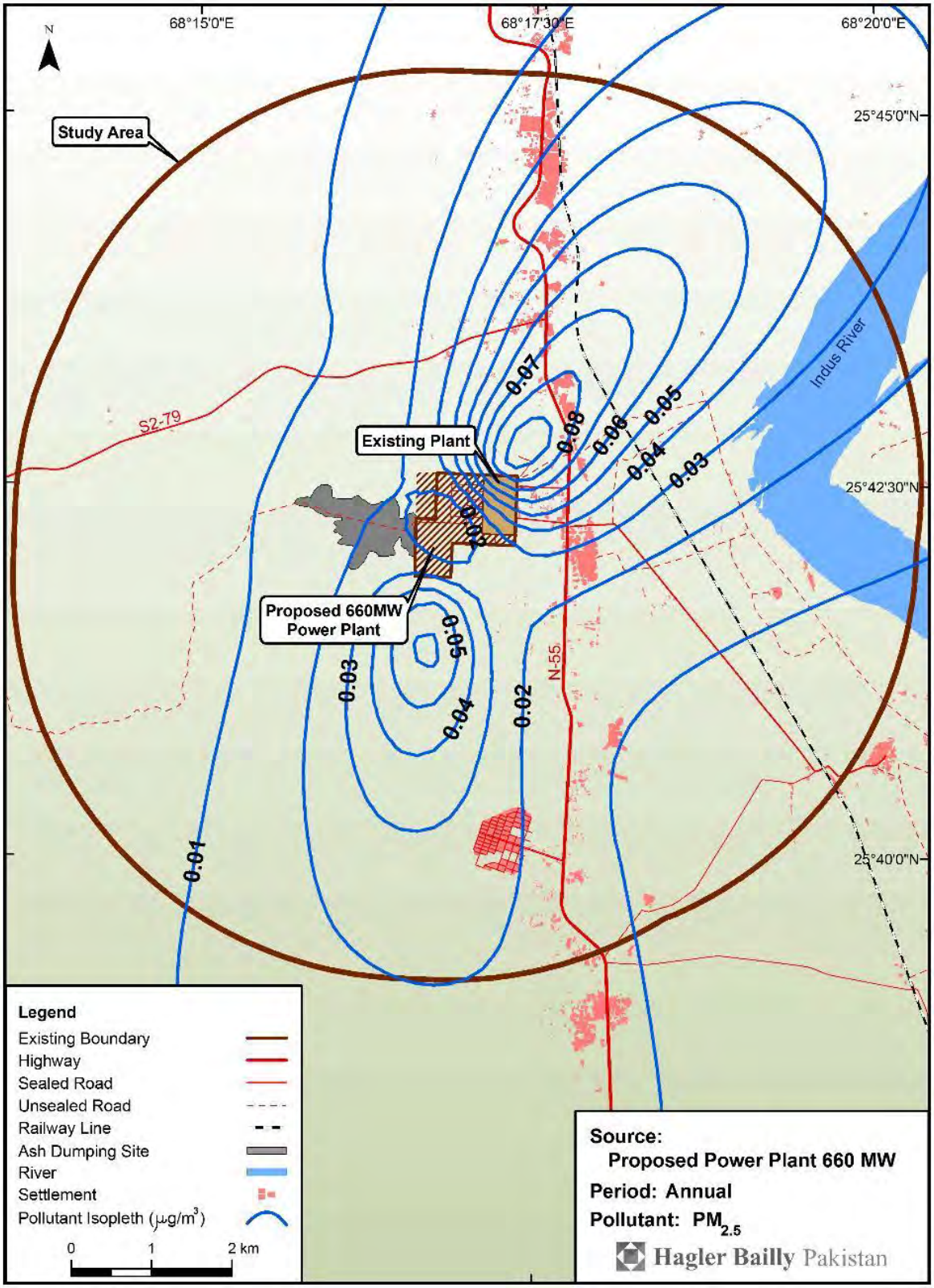
Figure 20: Predicted Increment to the 24–hour NO_2 Levels Caused by the Proposed Plant (Scenario 2)

Ambient Air Quality Impact of Imported Coal



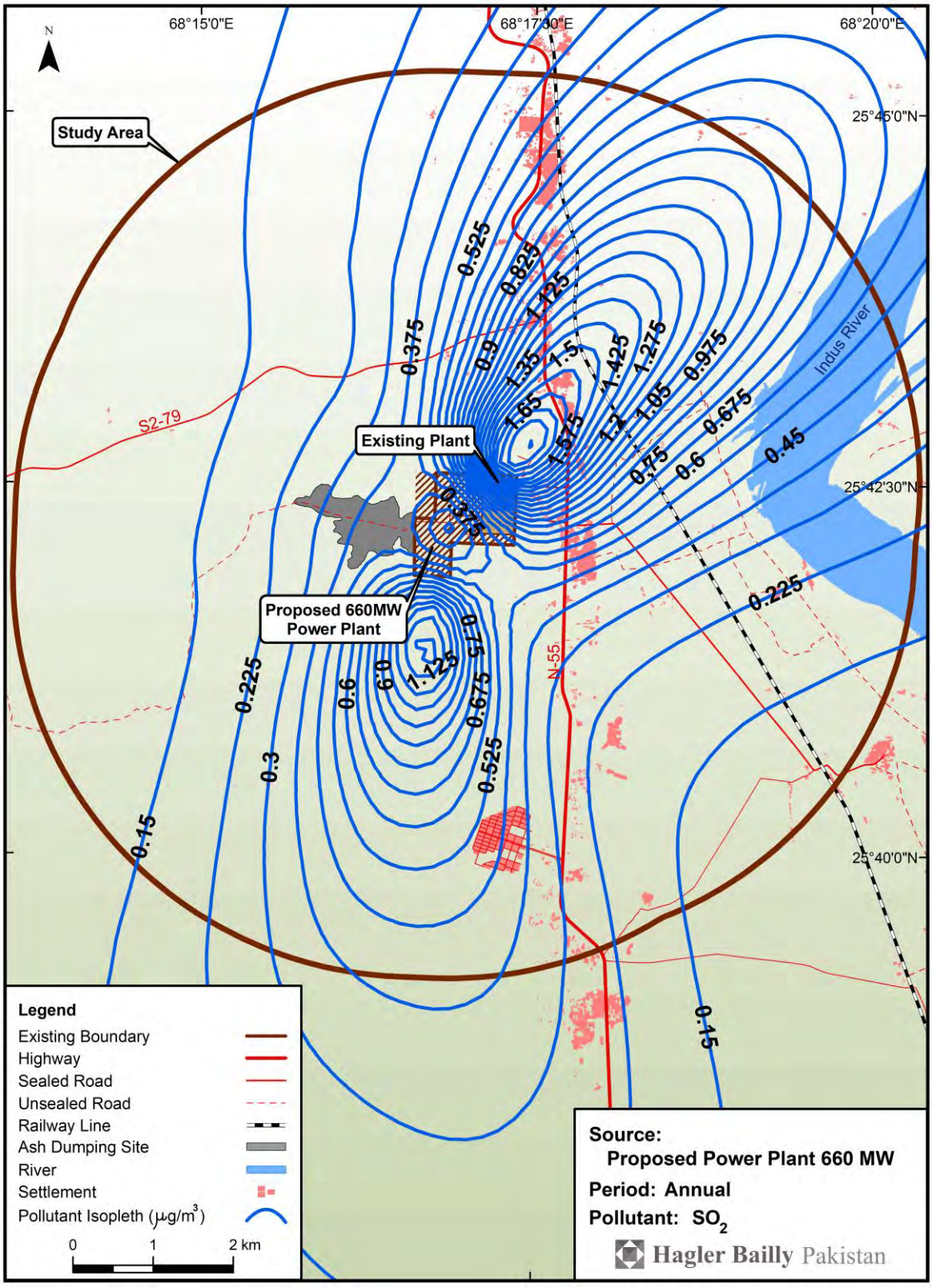
Source: Hagler Bailly Pakistan

Figure 21 : Predicted Increment to the Annual PM_{10} Levels Caused by the Proposed Plant (Scenario 2)



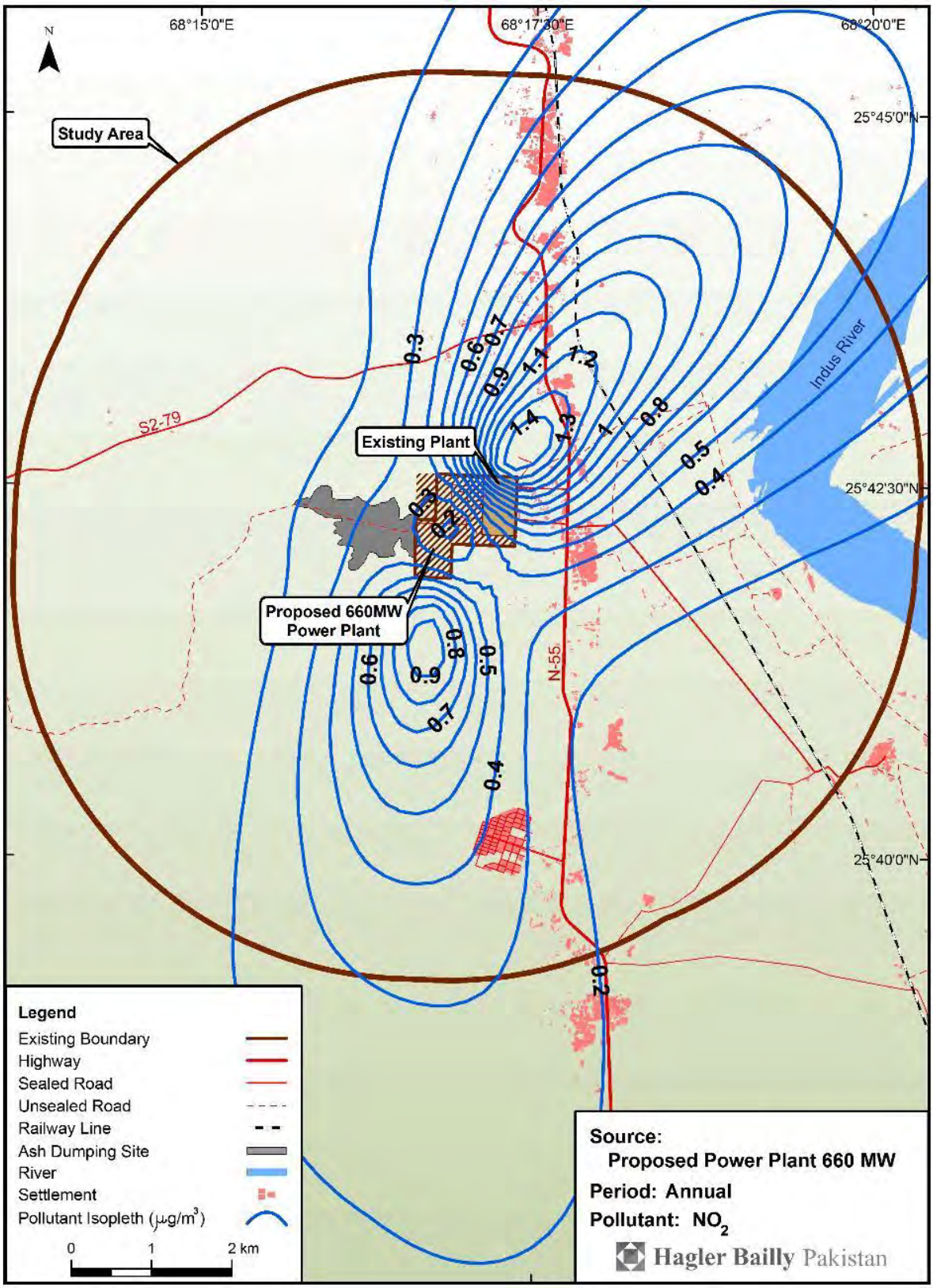
Source: Hagler Bailly Pakistan

Figure 22: Predicted Increment to the Annual $PM_{2.5}$ Levels Caused by the Proposed Plant (Scenario 2)



Source: Hagler Bailly Pakistan

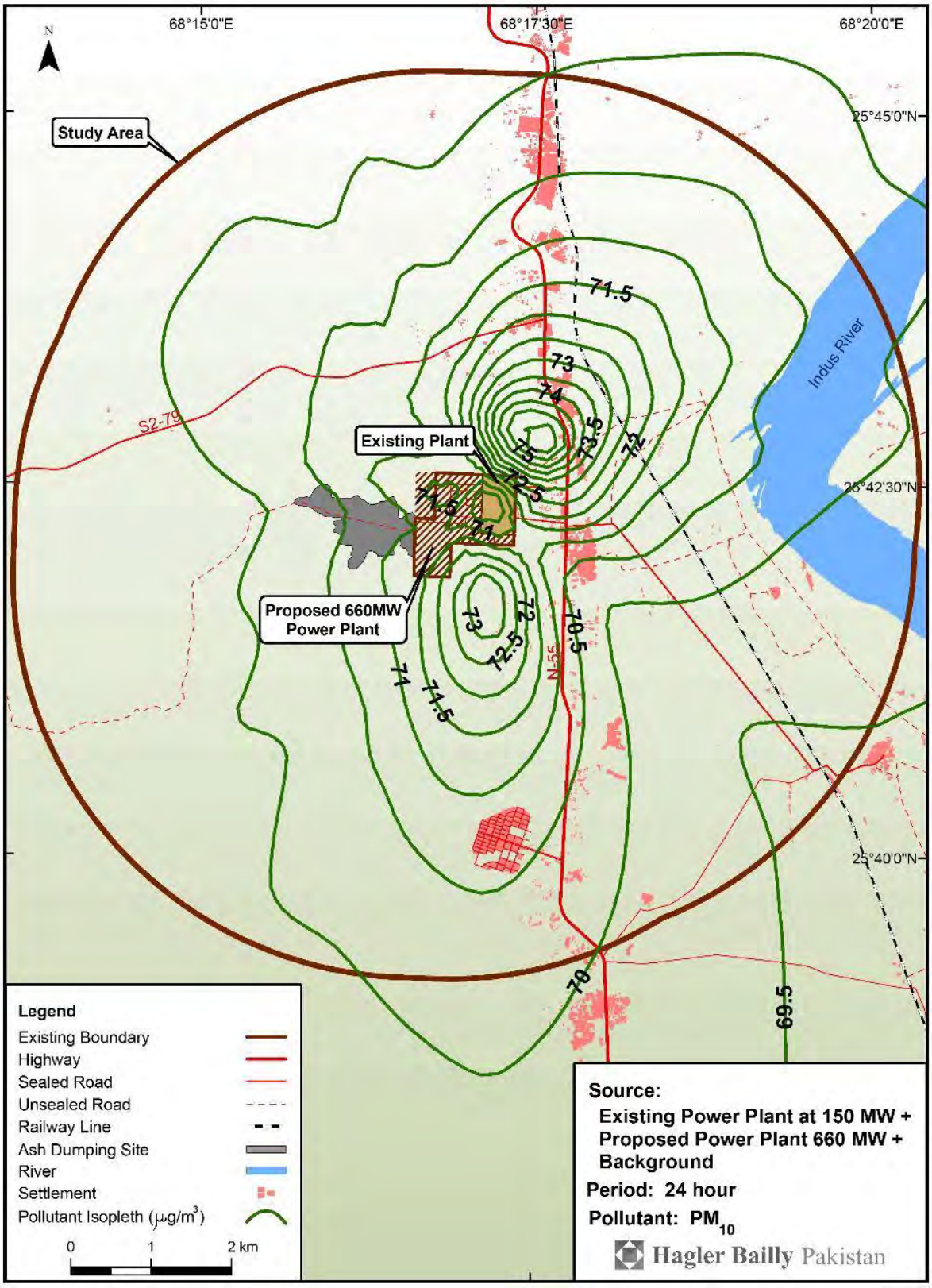
Figure 23: Predicted Increment to the Annual SO_2 Levels Caused by the Proposed Plant (Scenario 2)



Source: Hagler Bailly Pakistan

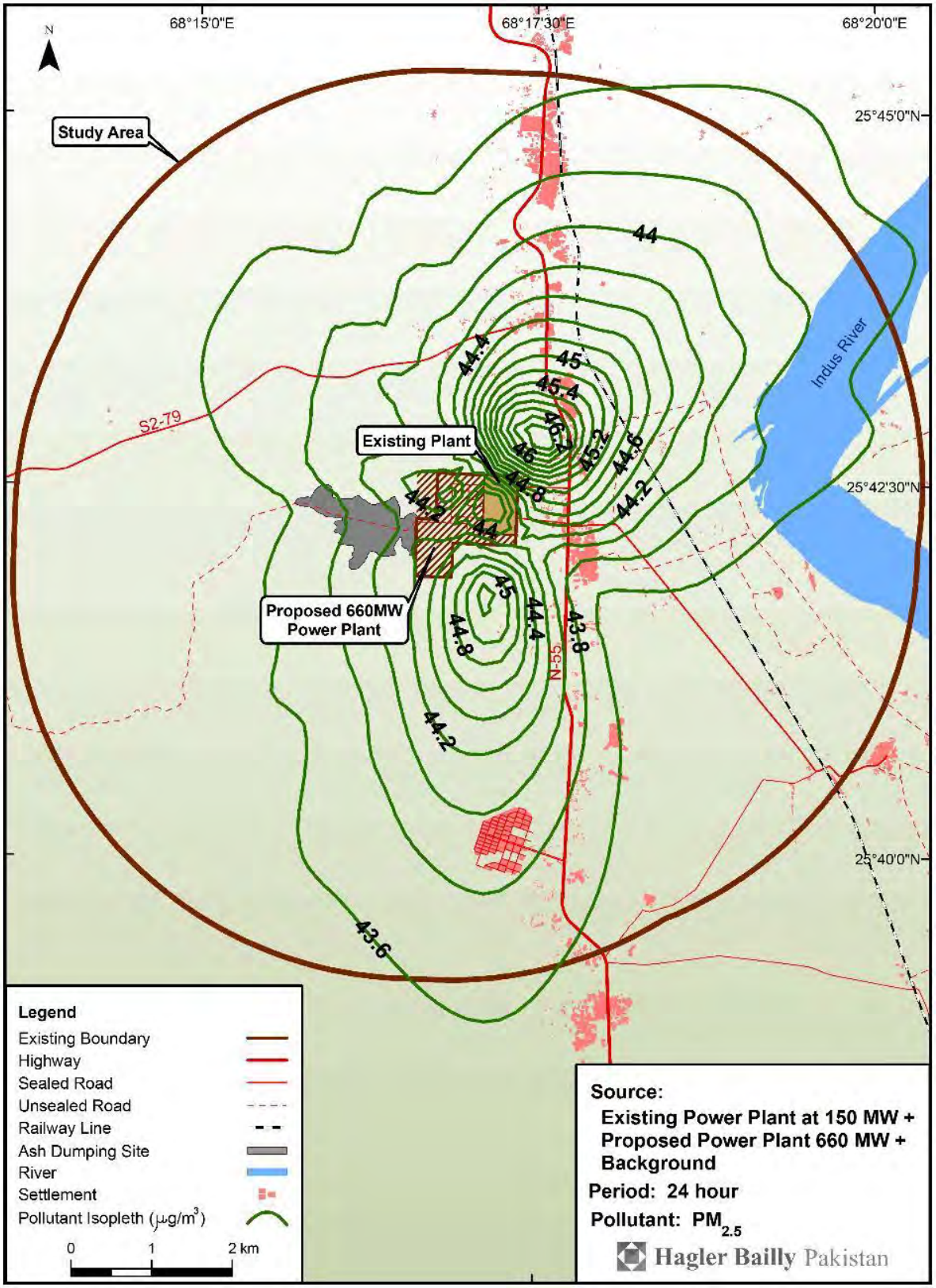
Figure 24: Predicted Increment to the Annual NO_2 Levels Caused by the Proposed Plant (Scenario 2)

Ambient Air Quality Impact of Imported Coal



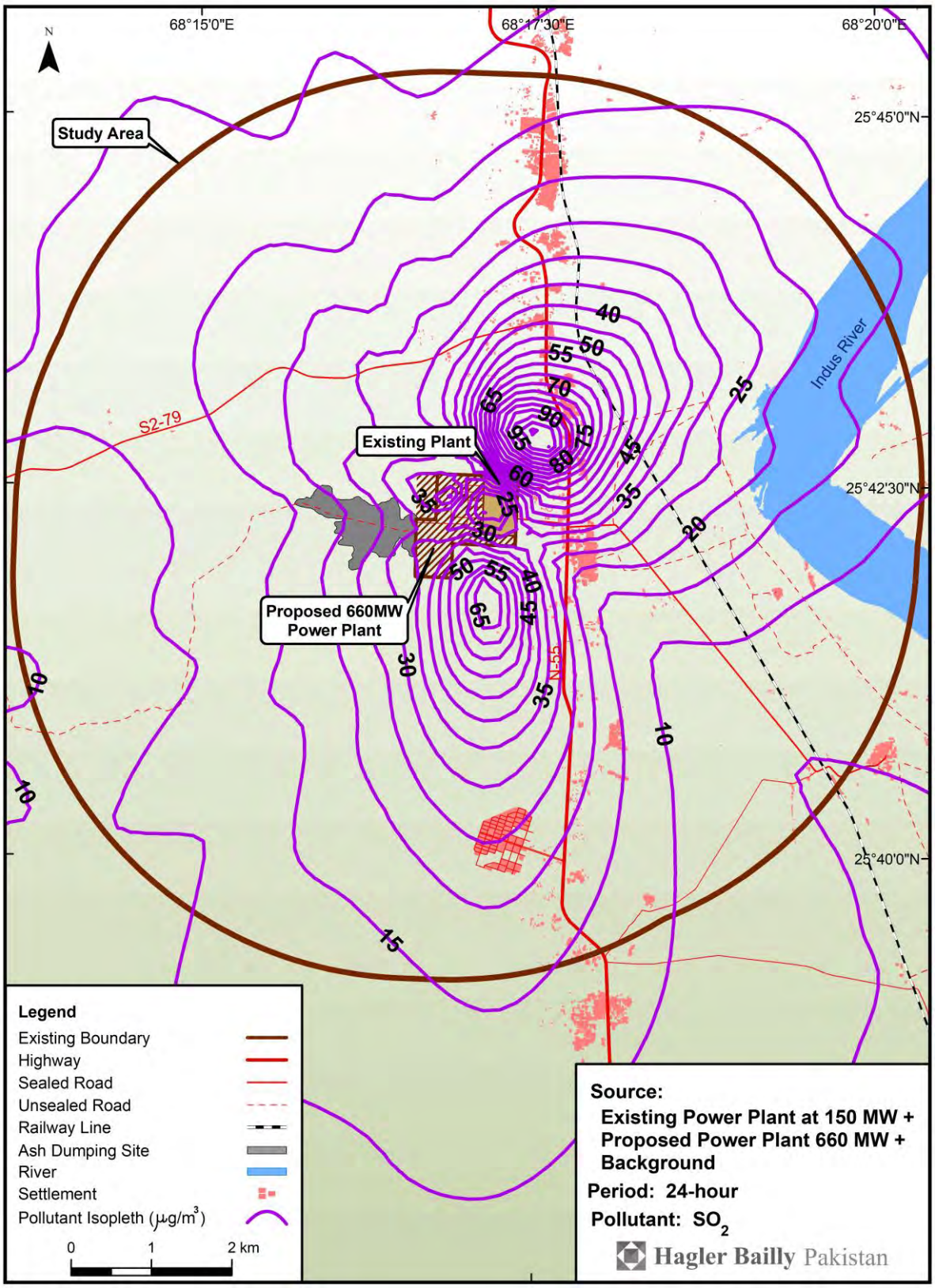
Source: Hagler Bailly Pakistan

Figure 25: Combined 24–hour PM_{10} Levels (Scenario 2)



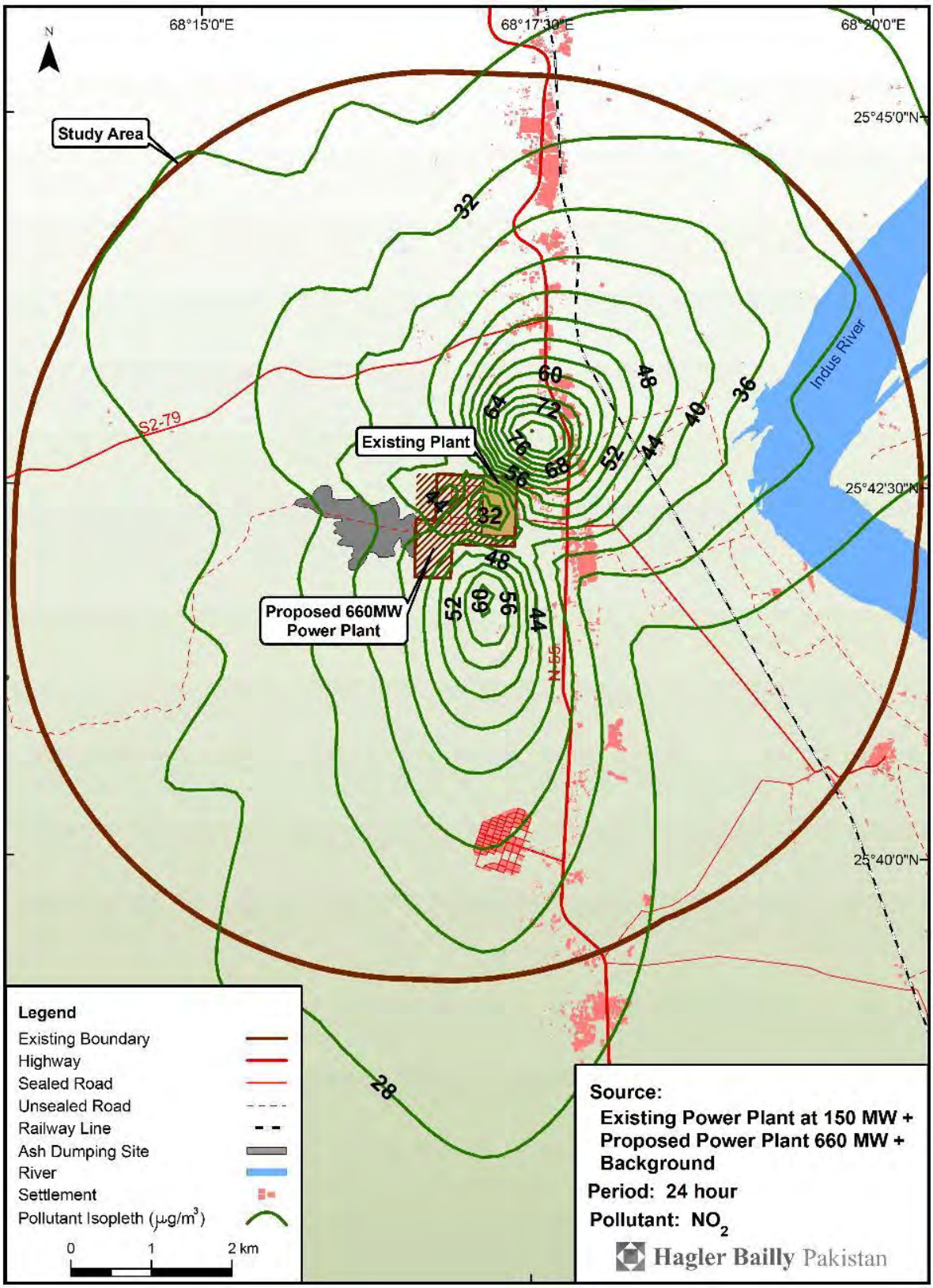
Source: Hagler Bailly Pakistan

Figure 26: Combined 24–hour $PM_{2.5}$ Levels (Scenario 2)



Source: Hagler Bailly Pakistan

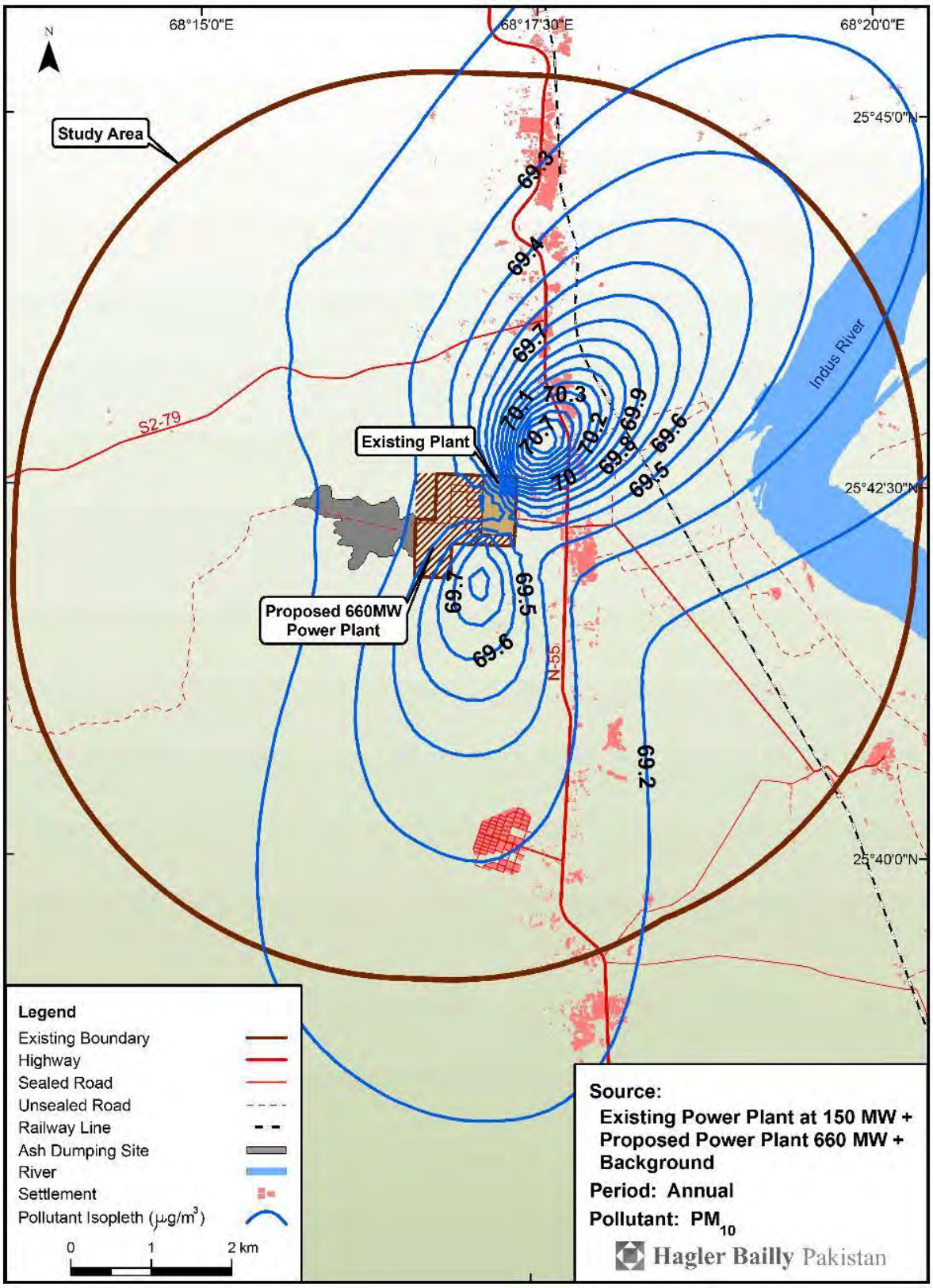
Figure 27: Combined 24–hour SO_2 Levels (Scenario 2)



Source: Hagler Bailly Pakistan

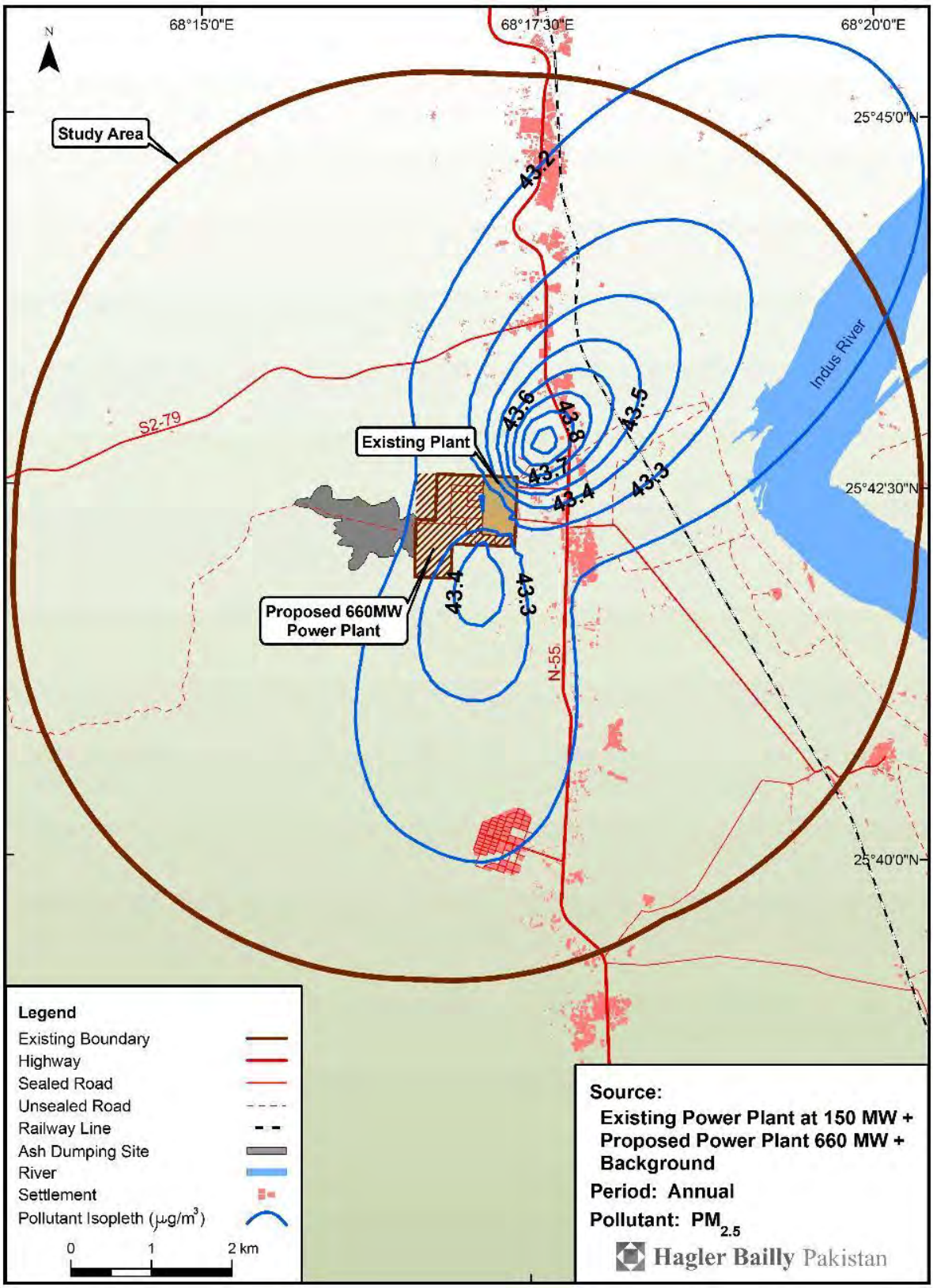
Figure 28: Combined 24–hour NO_2 Levels (Scenario 2)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

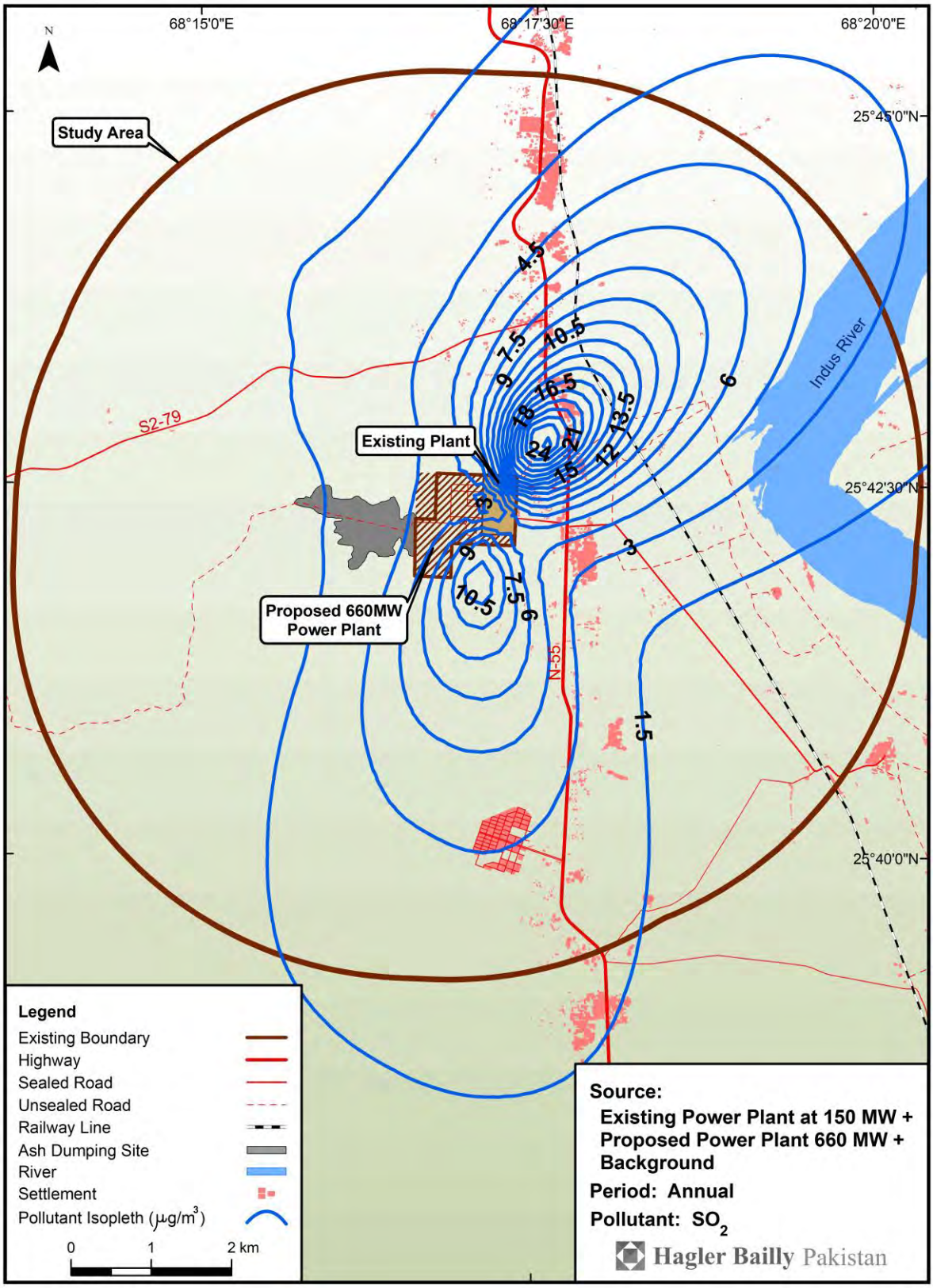
Figure 29: Combined Annual PM_{10} Levels (Scenario 2)



Source: Hagler Bailly Pakistan

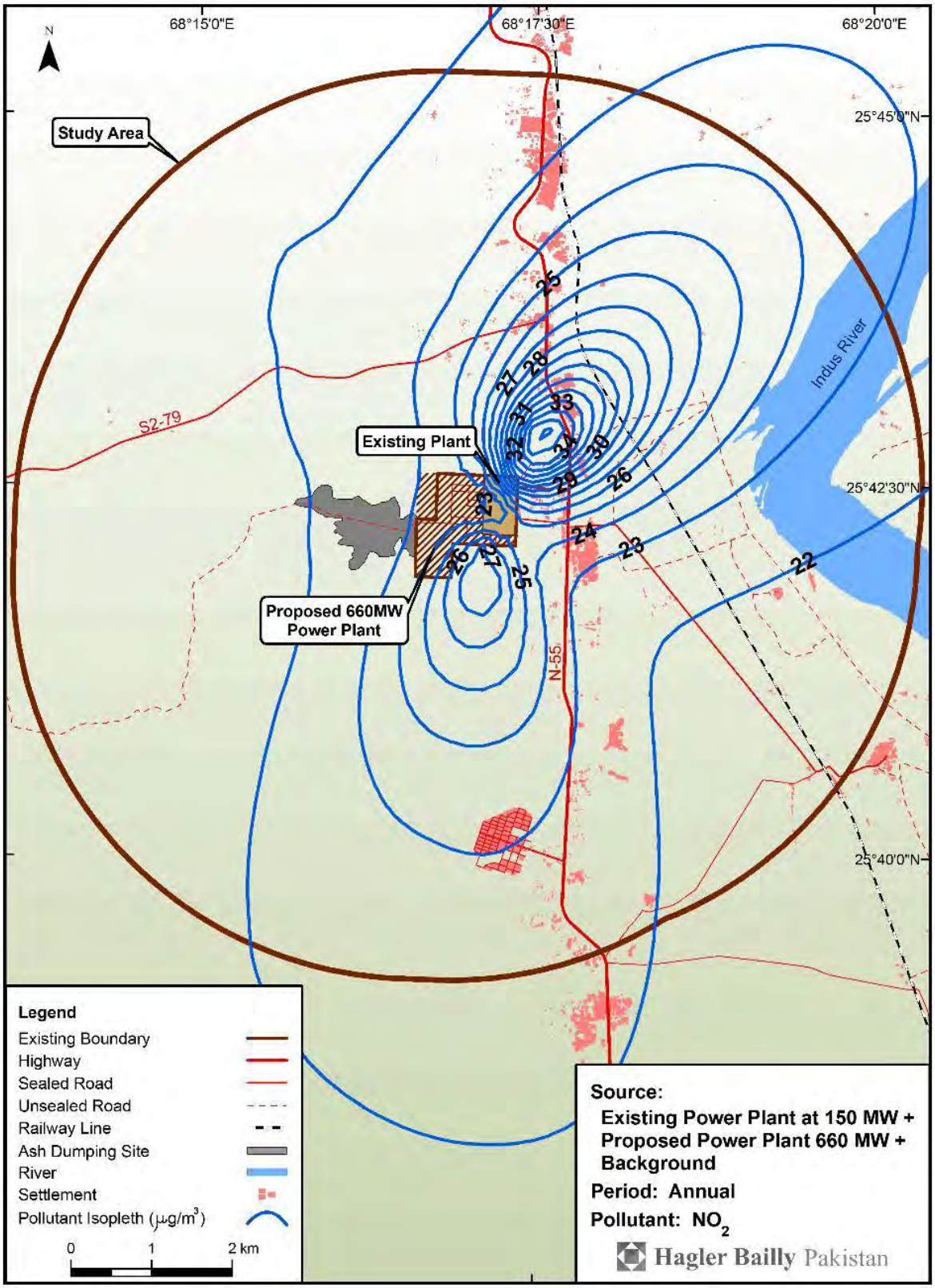
Figure 30: Combined Annual $PM_{2.5}$ Levels (Scenario 2)

Ambient Air Quality Impact of Imported Coal



Source: Hagler Bailly Pakistan

Figure 31: Combined Annual SO_2 Levels (Scenario 2)



Source: Hagler Bailly Pakistan

Figure 32: Combined Annual NO_2 Levels (Scenario 2)

12 - 1 ENVIRONMENTAL MITIGATION MANAGEMENT MATRIX FOR TRANSMISSION LINE

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
1	Land Resources					
a		Temporary acquisition of land for Tower Construction, Contractors Camps, access roads, aggregate quarries etc.	- Land would be acquired by short term lease agreement between the Landowners and Contractors. Rental terms should be negotiated up to the satisfaction of the concerned landowner. - Compensation for loss of crops, cropping seasons, and trees to be removed from the Tower locations in the 100 m wide ROW. - The other general guidelines to minimize the impacts on land use are: i. Project facilities should be located at a minimum distance of 500m from the major receptors i.e. built-up areas, wildlife habitats, archaeological, cultural monuments etc. ii. Prior to the commencement of the construction activities, the Contractor should submit a development plan to the Engineer in charge and the concerned EPA (if required) for its scrutiny and approval. ii. iii. Waste/barren land and natural areas located at high elevation should be used for setting up the Project campsite.	Environment & Social Expert, NTDC	- To make fair assessment of the compensation cost and affectees approval to be sought. - One window operation for quick payment to the affectees.	Before construction
b		Excavation of pits during the subsurface investigations for Tower foundations.	- Backfilling, compaction and leveling to original state will avoid the accidental mishaps to people and cattle as well as check the potential land erosion.	Contractor, Supervisory Consultants and NTDC.	Contractor adheres to the restoration clause.	During construction
c		Air Pollution due to the use of construction machinery and heavy vehicle during construction phase.	- Concrete batching plant should be equipped with dust control equipments i.e. fabric filters, wet scrubber etc. - NEQS should be enforced - Proper tuning of vehicles should be ensured.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement and regular monitoring by Supervisory Consultants.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			- Haul trucks should be covered with tarpaulin. - NTDC should setup air quality monitoring system along Project corridor.			
d		Noise Pollution due to the use of construction machinery and heavy vehicle during construction phase.	- Provide the casing to the noise generating machinery as use of noise absorbing material. - Proper tuning of vehicle and oiling of equipments moving parts. - NTDC should setup noise level monitoring system along the COI near construction activities.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement and regular monitoring by Supervisory Consultants.	During construction
e		Soil erosion due to the construction activities such as clearing and grabbing, excavation, filling, laying down concrete foundation for Towers and setting up construction camp.	- All disturbed areas should be protected against severe soil erosion by stripping and stockpiling of the available topsoil for later re-vegetation. - Special slop protection in the sensitive areas i.e. desert or semi desert areas.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction
f		Soil contamination due to the spillage of fuel, chemicals and lubricants during the construction of T/L.	- Contractors will train their workers in the handling and storage of the chemicals that can cause soil contamination. - Soil contamination due to concrete transportation will be minimized by placing all containers in casings. - Solid waste generated at the camp sites will be properly treated and safely disposed of only in the demarcated waste disposal sites.	Contractor, Supervisory Consultants and NTDC to monitor.	Contractor to implement regular monitoring.	During construction
g		Impacts on Public infrastructure i.e. roads, canals, existing power lines etc. during construction stage.	- For road crossings NTDC will provide adequate line clearance from road. Proper traffic management plan will be prepared and construction work will be carried out at off peak hours. - Canal crossing will not have any significant impact during the stringing action stage. - For Power lines crossing temporary shutdown of the	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			existing T/Ls will be carried out and proactive coordination will be made between the construction staff and concerned grid station operation staff.			
h		During the operational stage local people have to tolerate an excessive noise level due to the current flow in the conductors especially in the rainy season.	- To overcome this problem, the route has been selected to pass through the least populated areas. - Construction of houses and building structure within the COI will be avoided and NTDC will make sure to check such type of construction during the operation stage.	NTDC to monitor.	Regular monitoring.	During operation
i		During the operational stage, electric current (induction) may travel into the Towers due to short circuiting and may become a hazard to the public /animals.	- Earthing system of the Towers to avoid accidents and at least two diagonal legs of the Towers should be properly grounded.	NTDC to monitor.	Regular monitoring.	During operation
j		Collapse of the Towers due to the high wind or earthquake will be dangerous for human as well as animal life and can cause loss to property.	- The Towers are designed on the basis of proper subsoil investigations and climatic conditions of the area including maximum wind velocity and earthquakes which are normally based on last 50 years data. - At the time of detailed survey for fixing the Tower positions proper soil investigations will be carried out to check the presence of collapsible soils and if detected, Engineer will be informed immediately for design change. It will be ensured that no accident due to collapsing of Towers would occur during the life of the Project.	Contractor, Supervisory Consultants and NTDC.	Contractor will implement during construction and NTDC to monitor during operation.	During construction and operation
k		Limited use of agricultural land under the Towers during operation phase.	- After construction of Towers, the land can mostly be used for agriculture, as observed along the existing 66/132/220/500kV T/Ls in Pakistan.	NTDC	Fair compensation at the start of work and job opportunities should be provided to the affectees to off-set the loss of	During operation

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
					income due to the acquisition of their land.	
l		The electromagnetic field (EMF) due to current flow in proposed T/L can cause the risk of *leukemia* during operational stage.	- The Project has been planned to pass through the least populated area and the T/L will be kept at least 100 m from the populated areas even if some effects due to EMF are envisaged will be minimal due to safe distance. - A vertical clearance required as per international standards will be maintained especially near the populated areas. - Check will be kept by the NTDC that no construction will be allowed within 100 m of the proposed T/L.	NTDC to monitor.	Regular monitoring.	During operation
m		Breaking of conductors due to any mishap will cause a safety hazard due to the current flow in the fields and crossing over roads, canals, streams etc.	- The conductors are selected on the basis of local climatic conditions including maximum wind velocity, temperature and humidity conditions. So, there is almost no risk of breaking of conductors. However, due to some unavoidable circumstances, if such a situation occurs, NTDC (PEPCO) has provided such an arrangement that the flow in the conductors will be automatically tripped instantaneously.	NTDC	Regular monitoring.	During operation
n		The electronic devices / equipment may fail to work under the flux EHV T/L.	- The severity of this impact can be minimized by providing proper requisite clearance, for which observations should be made in the field under the existing EHV T/L deliberately.	NTDC	Regular monitoring.	During operation
2	Water Resources					
a		Contamination of surface and ground water resources from fuel and lubricants generated from the Contractors' camps, equipment wash yards, etc.	- The work will be carried out in such a manner that pollution of water resources is avoided. Fuel storage will be in proper bounded areas. Above surface storage tanks with polythene separators shall be used. All the spills and collected, waste products will be collected, stored and taken to the approved	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			disposal sites as directed by the Supervisory Consultants. - Construction camps should be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents. - For wastewater effluent according to the NEQS, the BOD5 concentration in sewage must be brought down to less than 80 mg/l and COD of less than 150mg/l should also be checked. - Similarly, if the sewage after treatment is to be discharged on to the land, it should meet the requirements of the NEQS for disposal of wastewater.			
b		Siltation of Natural Streams and Irrigation Channels	- The excavated material will be managed by ensuring proper storage areas at location should be far away from the water bodies - At sand dunes, proper slope protection should be provided to reduce the erosion of the slopes, which may cause the siltation of natural streams.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction
3	Ecological Resources					
a		Trees and shrubs clearing at the Tower locations for foundations, stacking of materials and assembly.	- Land holders should be paid reasonable compensation for the loss of their standing trees, in accordance with the prevailing market rates.	NTDC	Fair and prompt payment of compensation.	Before construction
b		Clearing of vegetation at location of camp facilities.	- Areas for construction camps should be kept to the minimum required. The camp sites should be located in plain areas, with minimum vegetation cover.	NTDC	Fair and prompt payment of compensation.	Before construction
c		Use of ecological resources for fuel purposes at camps.	- Staff and labour should be strictly directed not to damage any vegetation such as trees or bushes.	Contractor, Supervisory Consultants and	Contractor will get approval from Engineer for location of camp facilities.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
				NTDC.		
d		Adverse impact on agriculture in COI.	- Land holders will be paid compensation for the loss of their standing agricultural crops in accordance with the prevailing market rates as per LAA, Telegraph Act, NTDC practices, LARF and LARP specific to the Project. - The landholders will also be allowed to salvage the agricultural crops and other vegetation from the affected fields.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement, Supervisory Consultants and NTDC to check.	During construction
e		Wild animals like wild boar, jackal etc. will move away from the construction areas and may get hunted by labour. Some reptiles may get killed during digging and dragging operation.	- Hunting and harassing of wild animals will be strictly prohibited. - Activities such as construction of Towers, stretching of conductors and carriage of materials will not be allowed during the night in the wildlife sensitive areas. - Lights used in the camps during the construction will be kept to the minimum required. In the wildlife sensitive areas, upward scattering lights will preferably be used. - Vehicle speed should be controlled to avoid incidental mortality of small mammals and reptiles.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement, Supervisory Consultants and NTDC to check.	During construction
F		Birds will try to find shelter and food somewhere else and will tend to move away from the route of T/L due to the construction activities and fear of being hunted/ trapped or killed.	- Trees having habitat of birds should not be allowed to cut. - Special mitigation measures needs to be adopted to minimize impacts on the birds, such as avoiding construction activities during the critical periods of breeding and feeding. - Staff working on the Project should be given clear orders not to shoot, snare or trap any bird.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement, Supervisory Consultants and NTDC to check	During construction
g		During operation the T/L may become a danger to the	- Since there is an EMF around the high voltage T/L and excessive noise, no birds sit over the	NTDC	Regular monitoring.	During operation

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
		movement of indigenous birds and species and fatalities may occur if the birds sit on the conductors especially in the wet conditions.	conductors. - However, even if the birds sit over the conductors particularly in the wetland areas, the danger will arise if two phases of the current meet, but as there is 4.75 m to 5.50 m distance between the two opposite phased conductors, no danger to the birds is envisaged.			
4	Social and Cultural Resources					
a		Loss of crops.	- Compensation for the loss of crops to the land owners as per prevailing market prices. - The whole process of the payment should be transparent, judicious and without any discrimination or favour. - Minimum possible area should be disturbed for the construction of new paths or roads for carriage of machinery and materials. - Barren land without any crop should be selected for the camp sites.	NTDC	Fair and prompt payment of compensation.	Before construction
b		Due to the construction of the Tower foundations, erection and stringing of conductor, people will suffer loss in their annual income due to the loss of crops, trees, etc.	- Compensation for the crops and trees on private land will be provided to the affectees.	NTDC	- Fair, prompt and negotiated payment. - One window operation to ensure prompt payment of negotiated value. NTDC will pay the compensation.	Before construction
c		Removal of the infrastructure like buildings, huts, animal sheds, tube-wells, etc.	- Utmost efforts will be made to minimize the relocation/damage of infrastructure especially houses. - Compensation will be paid to the affectees for the built-up areas like buildings, huts, animal sheds, peter engines/electric motor sheds, etc. on replacement cost basis and the land on existing	NTDC to monitor.	Contractor to implement.	Before construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			agricultural land value. - Payment of three (03) months house-rent will be made to the affectees while they will construct a new abode for their families. - Full market price of any equipment (not shiftable) and cost of reconstruction including labor charges will be paid to the affectees. - Affectees will be allowed the salvaging of the demolished materials.			
d		Relocation of cultural and religious structures like mosques, shrines, graveyards, etc.	- Contractors will follow the realigned route of the T/L to avoid the relocation of cultural and religious structures. - Where unavoidable, proper compensation will be paid with the consultation of the community.	NTDC to monitor.	Contractor to implement.	Before construction
e		Impact on the houses, school animal sheds, etc. due to crossing of proposed T/L.	- Efforts are being made to avoid the school and houses by avoiding.	NTDC	Fair, prompt and negotiated payment in case of relocation.	
f		Income of the vulnerable people may be affected due crossing of T/L upon their infrastructure, affect of any asserts such as houses, tube wells room etc.	- The vulnerable persons shall be provided with all possible assistance and help for acquiring the skills and preference should be given to them for employment. The persons having no land or a person who is going to lose over 50% of his land will be considered as vulnerable people and will be specially treated to provide the maximum benefits.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement.	Before construction
g		Conflict over the use of local water resources between locals and Contractor to meet the camp and construction requirements.	- In areas of concern where the potable water is in short supply; the availability of water will be assessed to evaluate the impacts on the community resources. - Camps should be located at least 500 m away from the nearest local settlements. - Approval from the local administration and	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			representatives of the concerned irrigation departments will be obtained before using the local surface water resources. - The Contractors will be required to maintain close liaison with the local communities to ensure that any potential conflicts relating to the common resource utilization are resolved quickly. - Guidelines will be established to minimize the wastage of water during the construction activities and at campsites.			
h		The general mobility of the locals and their livestock in and around the COI will be affected temporarily on specific locations during the construction of proposed T/L.	- The contractor will select specific timings for stringing so as to cause least disturbance to the local population and their livestock considering their peak movement hours.	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction
i		Induction of outside workers by the contractor may cause conflicts with the locals on the cultural issues related to social and gender due to the unawareness of the local customs and norms. Theft problems to the community by the Contractor's workers and vice versa may also create social issues if outside labour is used by the contractor.	- Contractor will take care of the concerns of the local community and the sensitivity towards the local customs. - Good relations with the local communities will be promoted by encouraging the contractor to provide opportunities for skilled and unskilled employment to the locals, as well as on-job training for workers. - Contractor will restrict his permanent staff to mix with the locals to avoid any social issues. - Local vendors will be provided with regular business by purchase of the camp site goods and services from them. - The Contractor will warn the workers not to indulge in any theft activities. The Contractor camp should be fenced properly and main gate will be locked at	Contractor, Supervisory Consultants and NTDC.	Contractor to implement regular monitoring.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			night with a security guard to avoid any theft incidence.			
j		Construction of proposed T/L can cause the gender issues in the area during construction stage.	- The Contractors have to select the specific timings for the construction activities so as to cause least disturbance to women considering their routine movement hours. - The Contractor have to carry out the construction activities in such a way that the open field latrine usage timings by the local community particularly women, should not be affected. - Contractor should warn the staff strictly not to involve in any un-ethical activities with reference to the women. - While working on the erection of Towers, if privacy of the nearby households is affected, the Contractor will inform the house owner to make some arrangements.	Contractor, Supervisory Consultants and NTDC.	Contractor to will implement regular monitoring.	During construction
k		Construction activities will create health and safety issues for workers as well as locals will be more prone to serious accidents.	- Complying with the safety precautions for the construction workers as per ILO Convention No. 62, as far as applicable to the Project contract. - Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves, and protective masks, goggles, shields and monitoring their proper and sustained usage. - Ensure the provision of medicines, first aid kits, ambulance, etc. at the camp site. - Contractors should be warned to their staff about using Personnel Protective Equipments (PPEs) (e.g., wire containment, displaying warning signs along the work site, communicating advance	Contractor, Supervisory Consultants and NTDC.	Contractor to will implement regular monitoring.	During construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			warnings to mats) to enhance the blasting safety. - Safety lookouts will be built to prevent people and vehicles from passing at the time of blasting. - In the security vulnerable areas, special measures should be adopted by the Contractor as well as the Consultant staff with the consultation of the local responsible agencies to control the law and order.			
l		The land under the Towers during the operation stage may restrict the current land use for agriculture purposes.	- Affectees will be involved in the valuation process at all stages of the Project i.e. soil investigations, Tower footings, Tower erection and stringing of conductors.	NTDC	Regular monitoring.	During operation
m		The restriction of plantation of trees above 2.5 m height during the operation stage may also cause the inconvenience to the locals.	- Orchards of Guava and Citrus (except mangoes) with height less than 2.5 m can be grown. Similarly, cultivation of the crops can be carried out without any let or hindrance.	NTDC	Regular monitoring.	During operation
n		Due to the erection of Towers and the passing of T/L, the value of land may decrease in the long term basis.	- Since the erection of Towers will involve very limited amount of land and the land under the Towers and conductors can be easily used for crops, so not much depreciation in land value is foreseen.	NTDC	NTDC monitoring.	During operation

Source: EIA for T/L between Thar and Matiari

Environmental Mitigation Management Matrix for Transmission Line

Environmental Mitigation Management Matrix for Switching Station

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
1	Land Resources					
a		Permanent acquisition of land for the construction of Switching Station.	- Permanent land should be acquired as per Land Acquisition Act (LAA), 1894. - ADB policy requirements for Involuntary Resettlement should also be fulfilled. - Existing market price of the land should be paid to the landowner.	Environment & Social Expert, NTDC	- To make fair assessment of the compensation cost and affectees approval to be sought. - One window operation for quick payment to the affectees.	Before Construction
b		Temporary acquisition of land for Contractors Camps, access roads, aggregate quarries etc.	- Pease refer the mitigation strategy for "Temporary Land Acquisition" provided in Annex-X (a).	NTDC	- Fair compensation at the start of work and job opportunities should be provided to the affectees to offset the loss of income due to the acquisition of their land.	Before Construction
c		Soil erosion due to the construction activities such as clearing, excavation, filling, development of access roads, construction camps etc.	All the disturbed areas need to be protected against severe erosion losses by adopting following measures: - Stripping and stockpiling of all the available topsoil for later re-vegetation - Use of Proper drainage system above the works for significant protection - Planting of rapidly growing indigenous vegetation / grass in the Project Area to reduce the impact of soil erosion.	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
d		Air and noise pollution due to the use of construction machinery i.e. concrete	- Use of old tuned vehicles should not be allowed. - Proper tuning of the construction vehicles at	Contractors, Supervisory Consultants and	- Contractor to implement. - Regular Monitoring by Supervisory Consultants	During Construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
		batching plants, concrete paver, concrete mixer, excavators, dump trucks, road rollers, graders and heavy vehicle during construction phase.	appropriate intervals. - Haul-trucks should be kept covered with tarpaulin. - Batching plant should be sited at least 500 m away from the villages and settlements. - Control of heavy machinery speeds. Maximum speed of 30 km/hr should be practiced. - Concrete batching. plant should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions or at least water should be used during crushing operations to avoid air pollution. This water should be recycled to avoid generation of waste water. - The existing quarries should be used to borrow the aggregate materials and each quarry site should have a quarry management plan. - Where necessary, dust emissions should be reduced by regular sprinkling of water. - The NEQS applicable to the gaseous emissions should be enforced during the construction works. - Compliance monitoring of vehicles, generators and machines emissions (air and noise) to be regularly carried out. - Construction activities shall be avoided during the night time and mufflers should be provided in all the vehicles to minimize the emissions and noise. Noise complaints	NTDC to monitor.	and NTDC.	

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			should be logged and kept onsite by the Contractor. - Construction timings should be fixed after consultation with the residents of the nearby villages preferably during the day. This will minimize the disturbance to the local population. - If the proposed Project Area is near the hospital and college, the area where noise producing activity is to be undertaken should be screened with noise absorbing material or casing.			
e		The heating of the oil in the transformers at Switching Station and the heat generated due to current flowing through the supply lines will result in the emission of pollutants into the air, thus deteriorating air quality and affect human health.	To mitigate the pollutants emissions following measures should be adopted: - Transformers should be equipped with silica gel. - Use of low sulfur oil.	NTDC	- NTDC to monitor.	During Operation.
f		Routine inspection and repair work involving oil leakage from the transformers and other electric equipments can contaminate the soil.	- Impact on soil during operation phase will be insignificant. Good engineering practices should be adopted by the operation and maintenance (O&M) staff of NTDC (PEPCO) during the repair and replacement activities.	NTDC	- NTDC to monitor.	During Operation.
2	Water Resources					
a		Disposal of wastewater without treatment will pollute	- Domestic and chemical effluents from the construction camp should be disposed of by	Contractors, Supervisory	- Contractor to implement. - Regular Monitoring by	During Construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
		the soil and ground water.	the development of onsite sanitation systems i.e. septic tanks along with soakage pits. Proper monitoring to check the compliance of NEQS should be carried out. - Sewage from construction camps should be disposed of after proper pre-treatment and processes such as soakage pit. - The Contractor should also develop guidelines for the clean up of small spills on site. Proper PPE should be worn when cleaning the spills. Techniques for the spill cleaning should ensure that the spill is absorbed, neutralized and collected.	Consultants and NTDC to monitor.	Supervisory Consultants and NTDC.	
b		Improper waste management activities can increase disease transmission, contaminate ground and surface water and ultimate damage to the ecosystem.	- All the solid waste from the camps should be properly collected and disposed of through proper solid waste management system. - The Contractor should coordinate with local representatives and administration concerned department for the disposal of solid waste. - The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the ground water. - Secondly, the disposal site must be located as far as practical from populated areas and regions that have a high density of wildlife. - Toxic waste should be handled, stored,	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction

Environmental Mitigation Management Matrix for Transmission Line

No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
			transported and disposed of separately. - The waste should be properly sealed in containers with proper labels indicating the nature of the waste. - Solid waste should be segregated at source so that it can be re-used or recycled.			
c		Surface water quality of the natural ponds/nullahs and the other water bodies may be impacted due to the construction activities and wastewater from labour camps.	- Pease refer the mitigation strategy for "contamination of surface and groundwater resources during construction" provided in Annex-X (a).	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
3	Ecological Resources					
a		Movement of transport or vehicles produces noise and vibration in the area during topographical, geotechnical and seismic studies which will scare away the birds, wildlife, rodents and reptiles etc.	- This will not be a significant impact. However, this impact can be minimized by use of good engineering practices.	NTDC	- NTDC to monitor.	Before Construction
b		During the construction, clearing and grubbing activities, construction of access road, installation of batching plants and worker's camps, the natural vegetation and flora such as shrubs and herbs, including some species of medicinal	- While making paths for carriage of construction materials minimum land should be utilized and minimum vegetation should be disturbed. - Plantation is required in the area, where trees or bushes have been cut to make path. - The camps and workshop facilities should be established on the barren land; however, if such type of land is not available, it should	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction

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No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
		plants, fuel wood plants and trees will be removed which will have a significant adverse impact on the natural vegetation of the Study Area.	be ensured that minimum clearing of the vegetation occurs and minimum damage to the trees and undergrowth is ensured. - The Contractor's staff and labor will be strictly directed not to damage any vegetation such as bushes. - Contractor will provide the fuel wood/gas cylinders at the camps for cooking purposes and cutting the trees/bushes for fuel will not be allowed.			
c		Noise and noxious gases will be produced from the heavy vehicle, construction machinery and other activities during construction activities will scare away birds, wildlife, rodents and reptiles. Some of the avifauna may also get killed during construction works.	- Pease refer the mitigation strategy for "impact on wild animals and reptiles during construction" provided in Annex-X (a).	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
4	Social and Cultural Resources					
a		The general mobility of the locals and their livestock in and around the Project Area will be affected during the construction phase.	- Mobility of the Contractor's staff through the nearby residential areas should also be strictly prohibited by the Contractor to avoid any inconvenience or any risk. - Temporarily and for short duration, the Contractor has to select specific timings for construction work so as to cause least disturbance to the local population considering their peak movement hours.	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
b		Local water supplies	- Pease refer the mitigation strategy for	Contractors,	- Contractor to implement.	During

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No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
		utilization to meet the camp site and construction requirements may cause conflicts between the locals and the Contractors.	"impact of conflict over the use of local water resources during construction phase" provided in Annex-X (a).	Supervisory Consultants and NTDC to monitor.	- Regular Monitoring by Supervisory Consultants and NTDC.	Construction
c		Induction of outside workers by the Contractor may cause conflicts with the local people on the cultural issues related to social and gender due to the unawareness of the local customs and norms.	Following measures should be adopted in order to minimize the impacts. - The Contractor will be required to maintain close liaison with the local communities to ensure that any potential conflicts related to the use of common resource utilization for the Project purposes are resolved quickly. - Contractor will take care of the concerns of the local community and the sensitivity towards the local customs and traditions. - Good relations with the local communities will be promoted by encouraging the Contractor to provide opportunities for skilled and unskilled employment to the locals, as well as on -job training in construction for young people. - Contractor should restrict the staff to mix with the locals to avoid any social problems. - Local vendors will be promoted for routine regular business by purchase of the camp site goods and services from them.	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
d		With the influx of labor force and other staff related to the construction activities, daily activities of the women are likely to be affected.	- Pease refer the mitigation strategy for "impact gender issues during construction phase" provided in Annex-X (a).	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction

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No.	Resource	Envisaged Impacts	Mitigation Strategy	Responsibility	Action	Timing
e		Construction activities will create health and safety issue for the workers and the local community and they will be prone to accidents / incidents.	- Pease refer the mitigation strategy for "Health and Safety issues during construction phase" provided in Annex-X (a).	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
f		Excavation of land and drilling activities, storage of material and construction of workers camps, solid waste disposal by the workers and leakage and spillage of oil will affect the aesthetics of the area.	- Proper disposal of excavated material and back filling of land after construction activities will minimize the impact on the aesthetics of the Project Area.	Contractors, Supervisory Consultants and NTDC to monitor.	- Contractor to implement. - Regular Monitoring by Supervisory Consultants and NTDC.	During Construction
g		Due to the poor security situation in some areas of Punjab and Sindh there are security risks for the Contractor people.	- Special arrangements should be taken with the help of local heads for the Contractor staff to avoid any unpleasant incident. - Local heads should be involved in development works to gain confidence for local community.	NTDC	- NTDC to monitor.	During Operation

Source: EIA for T/L between Thar and Matiari

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添付資料 Y

Environmental Checklist for Transmission Line and Switching Station

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a)Y (b)N (c) (d)	(a) NESPAK have already submitted the transmission line EIA report to NTDC at December 2nd, 2013 presently. (b)NTDC have to submit EIA to SEPA and to be approved by NOC(No objection certificate), however not clear to submit to SEPA at December 2nd, 2013 presently(to confirm on the third site survey). (c) Cannot confirm by obtainable material. (d) Cannot confirm by obtainable material.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a)Y (b)Y	(a) The project was explained to the Local stakeholders and obtained to understanding. (b) The EIA report is reflected by comment which obtained at explanation meeting to local residents.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)Y	(a) The alternative plans were sufficiently examined concerning transmission line route, aspects of technology and cost, environment and social considerations.
2 Pollution Control	(1) Water Quality	(a) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered?	(a)N	(a) The measures such as depository of dredging and slope protection in sand hill area were considered to not become worse of water quality.
al Envir	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a	(a)N	(a) The project site is not include to protected areas.

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		possibility that the project will affect the protected areas?		
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock? (e) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments?	(a)N (b)N (c)Y (d)Y (e)N (f)N	(a) N/A (b) N/A (c) The adequate considerations are done to mammals and birds. (d) The measures such as construction regulation in the night are done. (e) N/A (f) The considerations are done to no result in extensive loss of natural environments.
	(3) Topography and Geology	(a) Is there any soft ground on the route of power transmission and distribution lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a)N (b)N (c)N	(a) N/A (b) N/A (c) The prevention measures of soil erosion (plantation, slope protection etc.) will be taken.
Envir	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize	(a)Y (b)Y	(a) According to LARP (December, 2012), eleven housings were scope of resettlement that these existed to foundations of steel tower. Impacts of

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		the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(c)Y (d)Y (e)Y (f)Y (g)Y (h)Y (i)Y (j)Y	resettlement were minimized by carrying out to consideration of alternative routes on the FS(July, 2012). (b) Explanation to local residents and group discussion were held twenty times on village belonged to COI. (c) Both of the compensation and resettlement plan are adequately considered. (d) The compensations are paid before resettlement. (e) The compensation policies are prepared in documents as LARP. (f) The payment of lump sum, employment short term / long term during construction / operation are conducted as supporting measures of livelihood recovery. (g) Agreement have to be obtained before resettlement, based on resettlement guideline of ADB and law of Pakistan. (h) NTDC will correspond how such as employ to local consultant. Budget will be ensured. (i) Monitoring will be planed by NTDC. (j) The grievance redress mechanism will be established using Community Complaints Register (CCR).
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (c) Is there any possibility that installation of structures, such as power line towers will cause a radio interference? If any significant radio interference is anticipated, are adequate measures considered? (d) Are the compensations for transmission wires given in	(a)Y (b)N (c)Y (d)Y	(a) The impacts to crops will be reduced by compensations during construction. (b) N/A (c) Safety isolation (more than 100m) will be ensured. (d) According to Telegraph Act 1910 of Pakistan, there is no permanent land acquisition below the transmission line, therefore it is possible to utilize as purpose of agriculture. The compensations of crops loss during construction will be corresponded to pay the assessment amount based on the market prices.

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		accordance with the domestic law?		
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)N	(a) N/A
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)N	(a) There is no impact to landscape, because transmission line construction site located desert or wasteland.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a)N (b)N	(a) There is no minorities and indigenous peoples at COI. (b) Same as above.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a)Y (b)Y (c)Y (d)Y	(a) The municipal lows (Pakistan Labour Policy, 2010 etc.) are observed. (b) Same as above. (c) Same as above. (d) The appropriate measures were taken.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce	(a)Y (b)Y (c)N	(a) The adequate measures will be taken to reduce impacts. (b) The adequate measures will be taken to reduce impacts about the ecosystem. (c) N/A

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		impacts?		
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a)Y (b)Y (c)Y (d)Y	(a) The appropriate environment monitoring will be planed and conducted (Recommended Monitoring Protocol) (b) Items, methods and frequencies of the monitoring program are judged to be appropriate. (c) The expert (commission) of environment and social implement under the supervision NTDC. (d) Regulated.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	(a)Y	(a) Waste, Noise and vibration, hydrometeor are given as the items of check list to concern the road. The appropriate measures will be taken to those items.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)N	(a)No items exists (a) N/A

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.