WHITE PAPER

POLLUTION OF RIVER SATLUJ

Causes, Consequences & a Sustaining Roadmap for Ecological and Water Security

Issued in Public Interest by

Public Action Committee (PAC)

Mattewara Jungles, River Satluj & Buddha Darya, Ludhiana

EXECUTIVE SUMMARY

River Satluj is one of Punjab's most important ecological and water-security lifelines. Its deterioration is no longer merely an issue of visible pollution; it represents a systemic threat to surface water, groundwater, agriculture, biodiversity, wetlands and the long-term environmental security of Punjab.

The problem is aggravated by two forces acting simultaneously:

First — excessive pollution loading: untreated or inadequately treated municipal sewage, industrial effluents, dairy waste, solid waste and polluted drains continue to enter the river system.

Second — inadequate ecological flow: during prolonged low-flow periods, particularly from approximately September to March, the river's capacity to dilute, assimilate and naturally recover from pollution is severely reduced.

The stretch from the Phillaur region towards Harike therefore becomes particularly vulnerable during the lean season.

Among the most important pollution pathways are the Swan/Suan River, Sirsa/Sarsa River, Chitti Bein–Kalsanghia Drain system, Buddha Darya and other sewage/drainage outfalls entering the Satluj system.

For Ludhiana, the challenge requires a fundamental change in approach.

The present system largely follows:

Generate wastewater → collect/mix → treat partially → discharge into Buddha Darya → ultimately transfer pollution towards River Satluj.

The future system must instead become:

Segregate → Pre-treat → Treat → Polish → Reuse → Recycle → Zero Untreated Discharge

The central recommendation of this White Paper is therefore the development of Self-Sustaining Industrial Clusters and Integrated Treatment Nodes, supported by the planned relocation of scattered polluting industries into properly serviced industrial clusters.

Such clusters should contain their own ETPs, CETPs, STPs, tertiary treatment, water-recovery and reuse infrastructure, with the ultimate objective of zero untreated industrial discharge into Buddha Darya, River Satluj, stormwater drains, sewer networks or the subsoil.

The transformation should not rely only upon punitive enforcement. Government should create a system of incremental incentives under which industries receive progressively greater benefits for relocation, cleaner production, wastewater segregation, water recycling and verified reductions in freshwater consumption and pollution loading.

The objective should be straightforward:

«Not merely to treat pollution after it has been created, but progressively to eliminate the very pathways through which pollution reaches Buddha Darya and River Satluj.»

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1. *IMPORTANCE OF RIVER SATLUJ FOR PUNJAB*

River Satluj is:

- A major surface-water resource for drinking water, irrigation and economic activity.

- The backbone of important canal systems.

- A contributor to groundwater recharge.

- An ecological corridor supporting floodplains, forests, wetlands and biodiversity.

- An important source supporting Punjab's agricultural economy.

- The principal freshwater influence upon the internationally important Harike Wetland ecosystem.

Pollution of Satluj therefore has consequences far beyond the river channel.

It potentially affects:

River → Canals → Agricultural Land → Groundwater → Crops → Food Chain → Human Health → Wetlands → Biodiversity.

Protection of Satluj must consequently be treated as a matter of Punjab's water, food, ecological and public-health security.

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2. *MAJOR POLLUTION PATHWAYS*

2.1 Swan / Suan River — Himachal Pradesh to Punjab

Originating in the Shivalik region, the Swan/Suan system passes through areas influenced by urbanisation and industrial development before interacting with Punjab's river system.

Potential pollution pressures include industrial wastewater, municipal sewage, solid waste and contaminated runoff.

Industrial areas around Santokhgarh, Tahliwal and Mehatpur require rigorous interstate monitoring.

Punjab and Himachal Pradesh should establish joint real-time water-quality surveillance at interstate entry points, supported by periodic independent sampling.

2.2 Sirsa / Sarsa River

The Sirsa/Sarsa system receives pressures associated with the heavily industrialised Baddi–Barotiwala–Nalagarh belt.

Concerns include:

- Industrial effluents.
- CETP performance.
- Municipal wastewater.
- Solid-waste dumping.
- Contaminated stormwater.
- Ecological disturbance and mining pressures.

Because pollution crosses administrative boundaries, an interstate river-basin mechanism is necessary rather than fragmented district-level responses.

2.3 Chitti Bein–Kalsanghia Drain System

This drainage system carries pollution pressures from urban, rural and industrial areas through parts of the Jalandhar–Kapurthala region towards the Satluj system.

Potential contributors include:

- Industrial wastewater.

- Urban sewage.

- Rural sewage.

- Solid waste.

- Organic pollution.

- Pathogens and, depending upon source industries, potentially toxic contaminants.

Each major outfall should therefore be treated as an identifiable pollution-loading point, with measurable responsibility and time-bound remediation.

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3. *BUDDHA DARYA & BHATTIAN DRAIN — THE CRITICAL LUDHIANA CHALLENGE*

Buddha Darya and Bhattian Drain represent the most serious pollution pathways affecting River Satluj.

Its pollution burden arises from a combination of:

- Domestic sewage.

- Dyeing and textile-processing effluents.

- Electroplating and metal-processing wastewater.

- Sheet-metal and engineering activities.

- Paint and chemical-related discharges.

- Paper and cardboard industries.

- Food-processing wastewater.

- Dairy waste.

- Hospital and laboratory liquid waste.

- Hospitality-sector wastewater.

- Industrial units operating in mixed-land-use and scattered locations.

- Illegal connections to sewer and stormwater networks.

- Inadequately treated discharge from treatment infrastructure.

This creates an unacceptable situation in which a natural watercourse increasingly functions as the final conveyance channel for the residual pollution of an entire urban-industrial system.

Buddha Darya and Bhattian Drain must cease to be Ludhiana's wastewater disposal channel.

That principle should become the foundation of future policy.

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4. *THE HIDDEN POLLUTION PATHWAY — INDUSTRIAL EFFLUENT THROUGH MUNICIPAL SEWERS*

One of the most serious weaknesses requiring urgent attention is the discharge of industrial wastewater into municipal sewer networks.

A municipal STP is fundamentally intended to handle predominantly domestic sewage within its designed hydraulic and pollution load.

When industrial wastewater containing abnormal concentrations of chemicals, salts, metals, dyes or other contaminants enters the same sewer:

Industrial Effluent + Domestic Sewage → Mixed Wastewater → STP → Inadequate Treatment → Drain/Buddha Darya

This creates several problems:

- Industrial pollution becomes difficult to identify at source.
- Biological treatment processes may become stressed.
- Sewage sludge can become contaminated.
- Treatment efficiency may deteriorate.
- Polluter accountability becomes diluted.
- Industrial pollution can effectively become transferred to the public sewage-treatment system.

Industrial effluent should therefore not be permitted to disappear anonymously into municipal sewage.

Every significant industrial wastewater generator must have an identifiable treatment and disposal/reuse pathway.

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5. *DIRECT CETP DISCHARGE INTO BUDDHA DARYA — THE STRUCTURAL QUESTION*

CETPs were created to solve industrial pollution collectively.

However, a fundamental question must be asked:

Should a CETP's normal operating philosophy end with discharge into Buddha Darya?

The long-term answer should increasingly be No.

Even where an outlet complies with prescribed discharge standards, continuously transferring large volumes of treated industrial wastewater into a severely stressed and low-flow watercourse may not represent the best sustainable solution.

The policy should progressively move from:

CETP → Buddha Darya

towards:

CETP → Advanced Treatment → Recovery → Industrial Reuse

and, wherever technically feasible,

CETP → Recycle → Minimum Liquid Discharge / Zero Liquid Discharge

The ultimate objective should be that Buddha Darya receives environmental water, stormwater and legitimate ecological flows — not routine industrial wastewater.

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6. *SHIFT SCATTERED INDUSTRIES INTO PLANNED INDUSTRIAL CLUSTERS*

A major structural reform is required for industrial units operating in scattered locations, particularly where adequate pollution-control infrastructure cannot practically be provided.

The Government should develop a phased, legally supported and economically attractive relocation programme.

Instead of treating relocation only as punishment, industry should be given a positive economic pathway.

The principle should be:

The earlier an industry shifts, the greater the incentive.

The cleaner it operates, the greater the benefit.

The more water it recycles, the greater the reward.

Possible incentives may include:

- Preferential industrial plots.
- Rationalised relocation charges.
- Infrastructure support.
- Faster statutory clearances through a single-window mechanism.
- Financial assistance for common pollution-control infrastructure.
- Concessional financing for cleaner technology.

- Support for water-recycling systems.

- Shared renewable-energy infrastructure.

- Priority benefits for industries achieving verified water-reuse targets.

- Transitional assistance for compliant micro and small enterprises.

Incentives must, however, remain performance-linked and time-bound, with progressively stronger enforcement against industries refusing to relocate or comply after reasonable transition periods.

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7. *SELF-SUSTAINING INDUSTRIAL CLUSTERS*

Ludhiana should progressively develop or retrofit major industrial areas — including Focal Point, Industrial Areas A, B and C and other identified industrial concentrations — into environmentally self-sustaining clusters.

Each cluster should function almost like an independent environmental utility.

Every major cluster should have:

1. Separate sewerage networks

Domestic sewage and industrial effluent must remain segregated.

2. Individual ETPs where required

Industries generating specialised or hazardous effluent should undertake mandatory pre-treatment.

3. Cluster CETPs

Compatible industrial effluents should receive collective secondary/advanced treatment.

4. Dedicated STPs

Domestic sewage generated within industrial clusters should be treated separately.

5. Tertiary Treatment & Polishing

Treated wastewater should undergo further treatment appropriate to its intended reuse.

6. Water Recovery Systems

High-quality treated water should be recovered instead of being discharged.

7. Reuse Distribution Network

Recovered water should be supplied back to industries through dedicated pipelines.

8. Sludge and Residue Management

Hazardous and non-hazardous residues must be scientifically handled, tracked and disposed/recovered.

9. Renewable Energy Integration

Solar energy, biogas where feasible and energy-efficient treatment should reduce operating expenditure.

10. Real-Time Monitoring

Flow and key water-quality parameters should be continuously monitored at major inlet and outlet points.

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8. *INTEGRATED TREATMENT NODES — A NEW MODEL FOR LUDHIANA*

Instead of creating isolated treatment plants, Ludhiana should develop a network of Integrated Treatment Nodes.

Each node should serve a defined catchment or industrial cluster.

Conceptual Model

Industrial Units

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Source Segregation + Pre-treatment

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Dedicated Industrial Conveyance Network

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CETP / Advanced Treatment

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Tertiary Polishing & Water Recovery

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Reuse Reservoir

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Dedicated Recycled-Water Network

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Industries / Construction / Other Approved Uses

Simultaneously:

Domestic Sewage

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Dedicated Sewer Network

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STP

↓

Tertiary Treatment

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Reuse for Appropriate Non-Potable Purposes

The two streams should not be indiscriminately mixed.

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9. *MAKE TREATMENT NODES ECONOMICALLY SELF-SUSTAINING*

Treatment infrastructure cannot remain permanently dependent upon government grants while users continue consuming freshwater and discharging wastewater.

Integrated Treatment Nodes should progressively operate on a circular-water economy model.

Revenue may come from:

- Sale/supply of treated recycled water.
- Industrial user charges.
- Polluter-pays charges based on quantity and pollution load.
- Recovery of usable materials where technically and legally feasible.
- Energy recovery.
- Treated-water supply for construction and other approved purposes.
- Incentives for renewable-energy generation.
- Shared infrastructure contributions by cluster industries.

This converts wastewater from a liability into a recoverable water resource.

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10. *ZERO UNTREATED LIQUID DISCHARGE INTO BUDDHA DARYA AND SUBSOIL*

The final policy objective should be unequivocal:

No untreated industrial effluent into Buddha Darya.

No untreated industrial effluent into municipal sewers.

No industrial effluent into stormwater drains.

No illegal discharge into the subsoil through borewells, pits or other concealed arrangements.

Where ZLD is technically justified and legally required, it must be enforced. Elsewhere, equivalent high-recovery or minimum-liquid-discharge approaches should be evaluated based on industry type, wastewater characteristics, energy requirements and environmental outcomes.

ZLD should not merely mean removing liquid while creating an unmanaged solid-waste problem. Concentrates, salts and sludge must also have traceable and environmentally sound management.

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11. *CREATE A RECYCLED-WATER MARKET*

Punjab should recognise treated wastewater as an economic resource.

High-quality recycled water can potentially substitute freshwater for suitable purposes such as:

- Industrial processing where technically compatible.
- Cooling.
- Washing.
- Construction.
- Road and infrastructure works.
- Horticulture and landscaping where permissible.
- Certain non-potable municipal applications.
- Other uses approved under applicable water-quality standards.

Every litre safely reused represents one litre less freshwater extracted and one litre less wastewater requiring environmental disposal.

This creates a double environmental dividend.

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12. *PROTECT MUNICIPAL STPs FROM INDUSTRIAL POLLUTION*

Municipal STPs should not become surrogate industrial-treatment plants.

Accordingly:

- Industrial connections to sewer networks should be mapped.
- High-risk industries should be identified.
- Sewer sampling should be undertaken at strategic upstream locations.
- Abnormal pollution should be traced to its source.
- Repeat offenders should face disconnection and environmental compensation according to law.
- Smart flow meters and appropriate online monitoring should be introduced at major industrial outlets.
- Industrial estates should maintain separate industrial and domestic wastewater networks.

The principle must be simple: Polluter Identified → Pollution Measured → Responsibility Fixed → Treatment Enforced.

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13. *ECOLOGICAL FLOW — TREAT THE RIVER AS A LIVING SYSTEM*

Pollution control alone will not restore Satluj if adequate environmental flows are absent.

A scientifically determined ecological-flow regime is required, particularly during lean months.

It should consider:

- Aquatic ecosystem requirements.

- Water quality.

- Seasonal hydrology.

- Groundwater interaction.

- Wetland requirements.

- Harike ecology.

- Downstream water users.

Environmental flow must not be viewed simply as water "lost" downstream. It is water invested in maintaining the river system itself.

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14. *DRAIN-WISE POLLUTION INTERCEPTION*

Every significant drain entering Satluj should have its own pollution-reduction plan.

The principle should become:

No Polluted Drain Should Enter Satluj Unaccounted For

Actions should include:

- Mapping every major outfall.

- Quantifying dry-weather flow.

- Source identification.

- Interception of sewage.

- Industrial-discharge tracing.

- Trash traps.

- Silt management.

- Constructed wetlands where technically appropriate.

- Nature-based polishing.

- Continuous monitoring before confluence.

Each drain should have a named responsible agency, pollution-reduction target and deadline.

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15. *FLOODPLAINS, RIVERINE FORESTS AND WETLANDS*

River restoration cannot stop at wastewater treatment.

The wider ecological system must also be protected.

Priority actions include:

- Protecting active floodplains from incompatible development.
- Controlling illegal mining.
- Restoring native riverine vegetation.
- Reviving natural drainage pathways.
- Protecting wetlands and oxbow systems.
- Improving groundwater recharge.
- Establishing ecological buffer zones.
- Preventing dumping along riverbanks and drains.

Mattewara and other riverine forest landscapes should be viewed as ecological infrastructure, not vacant land awaiting conversion.

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16. *HARike WETLAND — THE FINAL ECOLOGICAL RECEIVER*

Pollution travelling downstream does not simply disappear.

Much of the cumulative burden eventually affects downstream river stretches and sensitive ecosystems including Harike Wetland.

Harike therefore requires a dedicated protection regime based upon:

- Upstream pollution-load reduction.
- Ecological-flow management.
- Nutrient monitoring.
- Heavy-metal surveillance.
- Sediment assessment.
- Biodiversity monitoring.
- Invasive-species management.
- Catchment-wide coordination.

Protecting Harike begins hundreds of kilometres upstream.

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17. *TRANSPARENCY — A PUBLIC RIVER HEALTH DASHBOARD*

Punjab should establish a publicly accessible Satluj River Health Dashboard.

It should display, wherever technically appropriate:

- River flow.
- Dissolved Oxygen.
- BOD.
- COD.
- Ammonia.
- pH.

- TDS/conductivity.

- Faecal coliform.

- Relevant heavy metals.

- STP performance.

- CETP performance.

- Drain-wise pollution loading.

- Treated-water production.

- Treated-water reuse.

- Freshwater consumption by major clusters.

Data should be understandable not merely to officials but also to citizens, farmers, researchers, industries and environmental organisations.

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18. *ACCOUNTABILITY MUST MOVE FROM PLANT CAPACITY TO ACTUAL PERFORMANCE*

Punjab frequently measures progress in terms of treatment capacity created.

The more meaningful questions are:

How much wastewater actually reaches the plant?

How much is actually treated?

What is its inlet quality?

What is its outlet quality?

How many hours is the plant functional?

Where does the treated water ultimately go?

How much is genuinely reused?

What happens during breakdowns and power failures?

Where do sludge, salts and concentrates go?

Therefore, future environmental audits should measure actual environmental outcomes rather than installed capacity alone.

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19. *PROPOSED PHASED IMPLEMENTATION*

PHASE I — EMERGENCY ACTION: 0–3 MONTHS

- Map major industrial and sewage discharge points.
- Identify illegal sewer connections.
- Inspect major CETP/STP outlets.
- Undertake independent sampling.
- Seal confirmed illegal industrial discharges.
- Prevent illegal subsoil disposal.
- Establish baseline pollution loading.
- Publish compliance information.

PHASE II — STRUCTURAL CORRECTION: 3–12 MONTHS

- Separate industrial and domestic wastewater streams in priority zones.
- Begin industrial-cluster relocation programme.
- Introduce incremental relocation incentives.

- Upgrade deficient STPs/CETPs.
- Establish recycled-water demand mapping.
- Begin dedicated reuse pipelines.
- Develop pilot Integrated Treatment.
- Construction of more CBG Plants in the area of Tajpur Dairy Complex.

PHASE III — SYSTEM TRANSFORMATION: 1–3 YEARS

- Complete priority industrial clusters.
- Develop cluster-level STPs, ETPs and CETPs.
- Establish advanced treatment and water-recovery systems.
- Reduce routine industrial discharge to Buddha Darya towards zero.
- Develop self-financing recycled-water networks.
- Establish drain-wise interception systems.

PHASE IV — ECOLOGICAL RESTORATION: 3–10 YEARS

- Restore natural river and drain ecology.
- Strengthen ecological-flow regimes.
- Restore floodplain forests and wetlands.
- Expand groundwater recharge.
- Restore biodiversity corridors.
- Transform Buddha Darya progressively from a wastewater carrier into a living urban watercourse.

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20. *THE PAC PROPOSED LUDHIANA MODEL*

The future pollution-control architecture of Ludhiana should be based upon:

DECENTRALIZE → SEGREGATE → PRE-TREAT → COMBINE COMPATIBLE STREAMS → TREAT → POLISH → RECOVER → REUSE → RECYCLE

supported by:

CLUSTER → INTEGRATED TREATMENT NODE → RECYCLED-WATER NETWORK → SELF-SUSTAINING OPERATION

and governed by one non-negotiable environmental objective:

ZERO UNTREATED DISCHARGE INTO BUDDHA DARYA, RIVER SATLUJ AND THE SUBSOIL

This model can progressively transform Ludhiana from one of Punjab's largest pollution-generating centres into a demonstration city for industrial circular-water management.

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21. *A NEW SOCIAL CONTRACT WITH INDUSTRY*

Industry must be regarded not merely as a polluter to be punished, but as an essential stakeholder that must also accept environmental responsibility.

Government should provide:

Infrastructure + Incentives + Technology Facilitation + Predictable Regulation.

Industry must provide:

Compliance + Cleaner Production + Treatment + Water Recovery + Financial Responsibility.

Citizens and civil society should provide:

Participation + Independent Observation + Constructive Oversight.

Regulators must provide:

Monitoring + Transparency + Enforcement without fear or favour.

This creates a partnership based upon responsibility rather than confrontation.

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22. *CONCLUSION — FROM POLLUTION MANAGEMENT TO WATER SECURITY*

River Satluj is Punjab's ecological spine.

The State cannot indefinitely continue extracting clean freshwater from nature, using it once, contaminating it and then spending public resources trying to treat the resulting pollution.

Punjab must move towards a circular water economy.

The transformation required is:

From scattered industries → organised green industrial clusters.

From mixed sewage and industrial wastewater → segregated treatment streams.

From isolated STPs/CETPs → Integrated Treatment Nodes.

From treated-water disposal → treated-water reuse.

From freshwater dependence → recycled-water substitution.

From pollution transfer → pollution prevention.

From government-funded treatment alone → progressively self-sustaining environmental infrastructure.

From drains carrying wastewater → restored ecological waterways.

And ultimately:

From a polluted Satluj to a Living Satluj.

This requires political will, scientific planning, industrial cooperation, regulatory enforcement and sustained community participation.

The expenditure required for restoring the river must not be regarded merely as a cost.

It is an investment in Punjab's water security, food security, public health and the survival of future generations.

The time for fragmented and cosmetic interventions has passed.

Punjab now requires a Basin-to-Cluster, Drain-to-River and Treatment-to-Reuse Mission for River Satluj.

A CALL FOR COLLECTIVE ACTION

Government must facilitate.

Industry must transform.

Regulators must enforce.

Scientists must guide.

Farmers and communities must participate.

Civil society must remain vigilant.

Together, Punjab can still restore its rivers.

SAVE SATLUJ — SAVE PUNJAB'S WATER FUTURE

For a Clean, Living and Sustainable River Satluj — for the Sustainable Green Mission of Punjab

Issued in Public Interest by

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