✅ 1. Prediction Models – AI predicts rainfall impact & waterlogging hotspots

How it works:

- Data needed: historical rainfall (IMD), drainage maps, terrain elevation (GIS), past flood reports.
- AI/ML models (like LSTM, ARIMA, Random Forest) can forecast rainfall intensity and map waterlogging risk zones.

Feasibility:

✔ Rainfall data is publicly available.
✔ GIS maps of Pimpri-Chinchwad exist with the municipal corporation.
✔ Models are computationally possible with Python/ML tools.

🔹 Already used in: **Mumbai flood forecasting system (IIT-B + IMD)** and **London's Thames flood alerts**.

✅ 2. Smart Monitoring – Using sensors + ML to detect blockages

How it works:

- Install **IoT sensors** in key drains to measure water level, flow, and pressure.
- ML detects abnormal readings (e.g., water level rises but flow decreases → blockage).
- Alerts go to municipal workers for cleaning **before flooding**.

Feasibility:

✔ IoT sensors are already cheap & available.
✔ ML anomaly detection is widely used (same concept as industrial machine monitoring).
✔ Civil + AIML collaboration makes it possible in targeted locations first (pilot project).

🔹 Already used in: **Singapore's Smart Drains** and **London Thames Water's IoT monitoring**.

✅ 3. Optimization – AI suggests best drainage routes by simulating water flow

How it works:

- Input data: elevation maps, rainfall data, land use, soil permeability.
- AI runs hydrological simulations + optimization algorithms (genetic algorithms, reinforcement learning).
- Suggests where new drains, recharge pits, or retention ponds should be built.

Feasibility:

✔ GIS & terrain data available from PCMC/civil teams.
✔ Simulation tools (SWMM, MIKE Urban) exist; AI can enhance them.
✔ Can be first tested virtually before implementation.

🔹 Already used in: **Netherlands flood defense planning**, **Tokyo's underground water tanks planning**.

✅ 4. Early Warning Dashboard – Real-time alerts for citizens & corporation

How it works:

- Collects data from:
    - Rainfall forecasts (weather APIs)
    - Drain sensors
    - Prediction models
- Dashboard / mobile app shows **real-time risk maps** and sends SMS alerts.

Feasibility:

✔️ Dashboards are easy to develop (Streamlit, React, PowerBI).
✔️ SMS / app-based alerts are already used for weather & disaster warnings.
✔️ Can start small (alerts only to municipal engineers), then scale to citizens.

🔹 Already used in: **Bangalore's BBMP flood warning system** and **Singapore PUB drainage alerts**.