

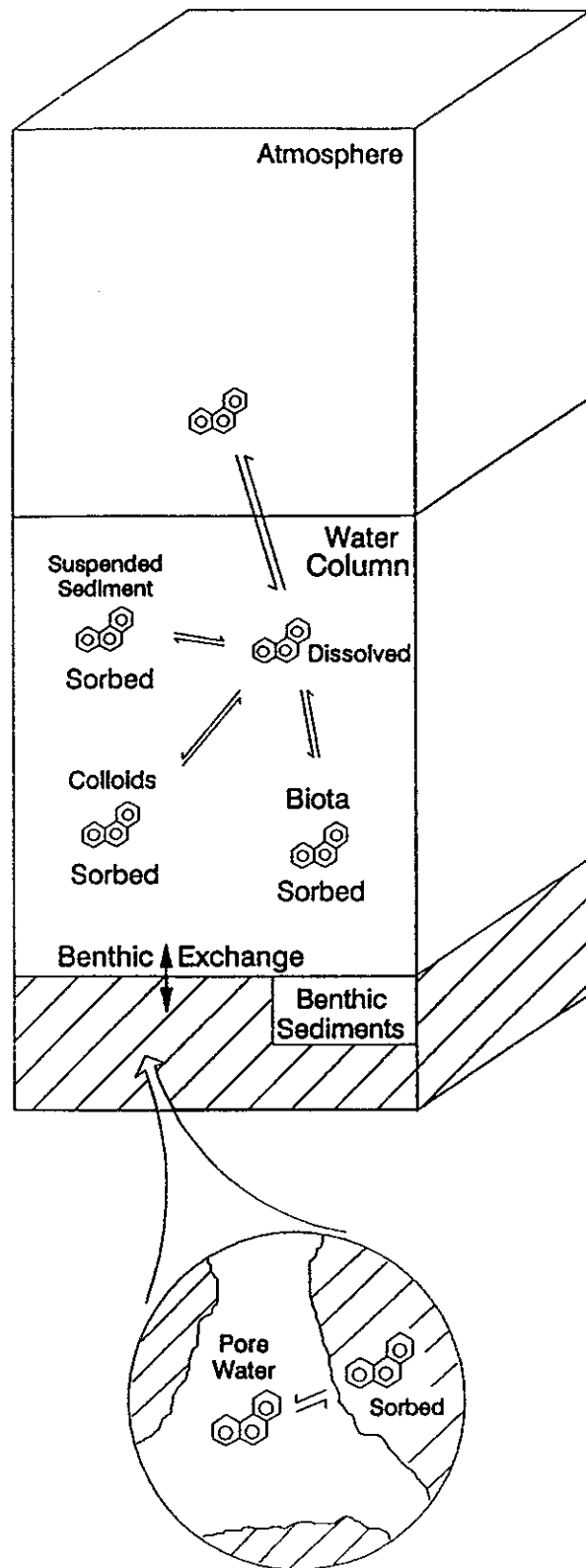
**A Symposium and Public Meeting on the State of
Newport Bay and Its Watershed**

**Hydrologic Processes and Their
Applicability to Newport Bay and
Its Watershed**

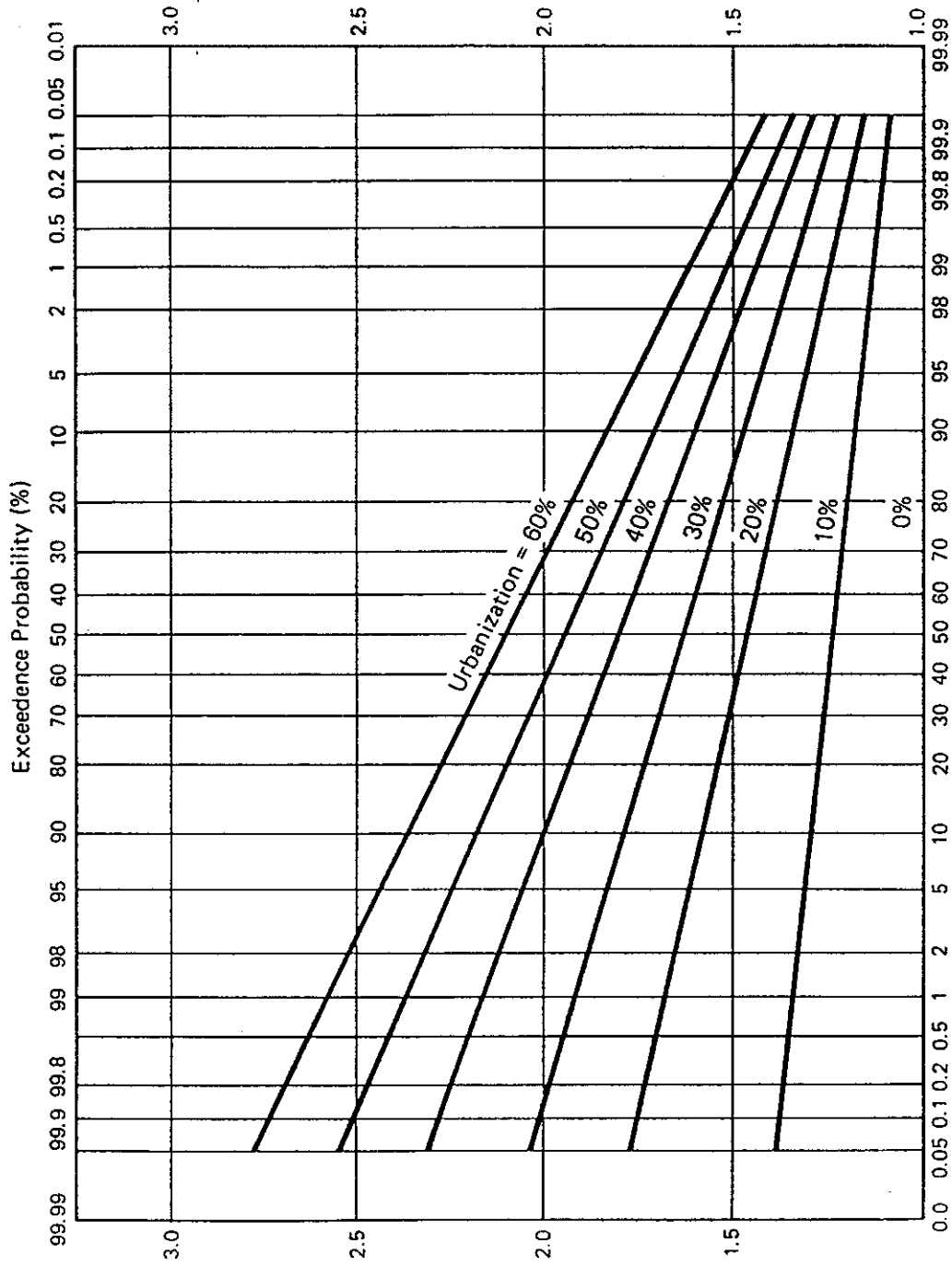
Presented at:

**National Academies of Sciences & Engineering
University of California, Irvine
Friday, October 24, 1997**

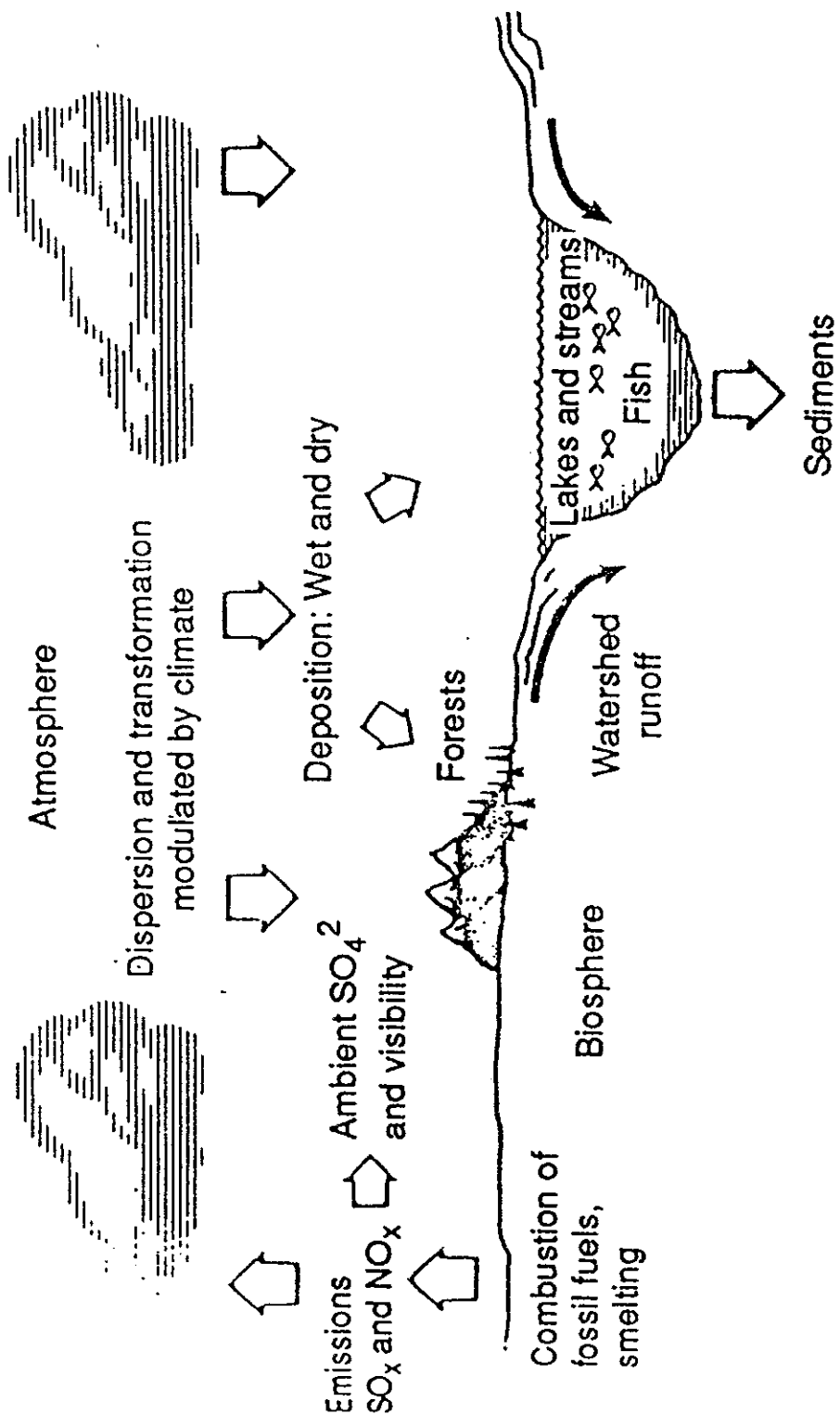
**Ted Hromadka, Ph.D., Ph.D., PH, PE
Principal and Director, Environmental Services
Failure Analysis Associates, Inc.**



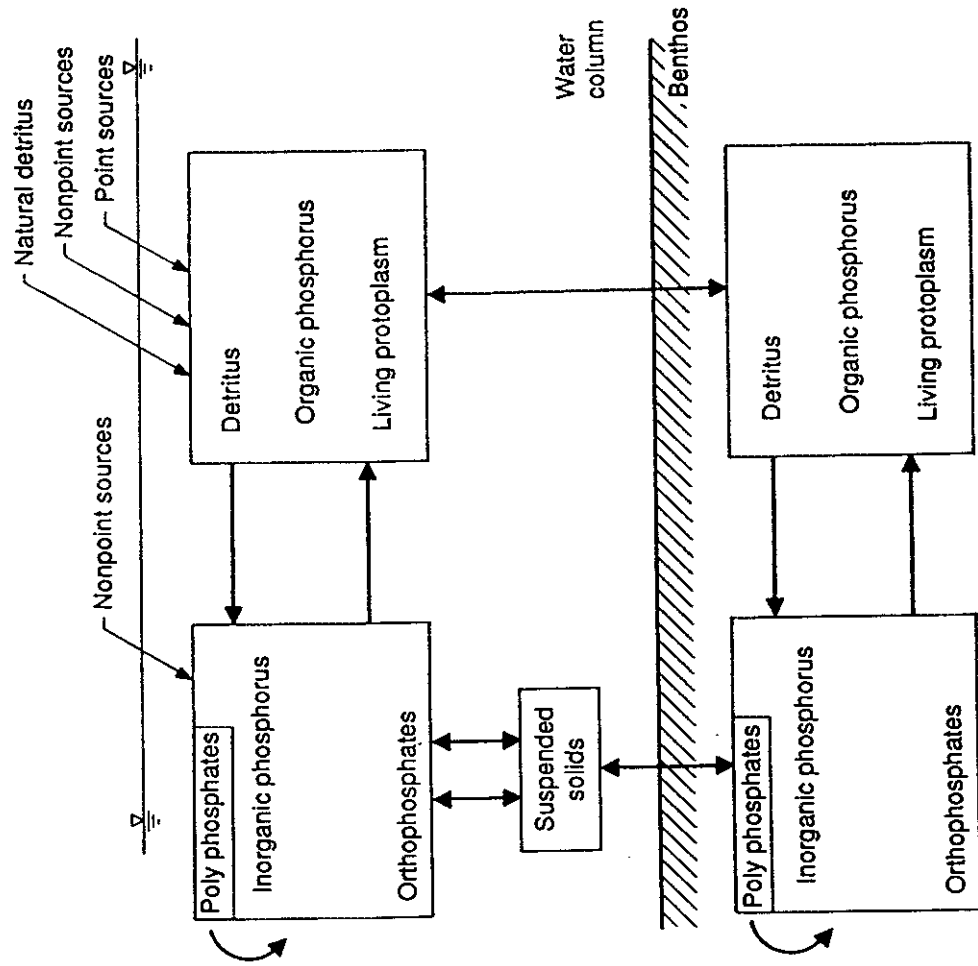
Distribution of Chemicals in Environment



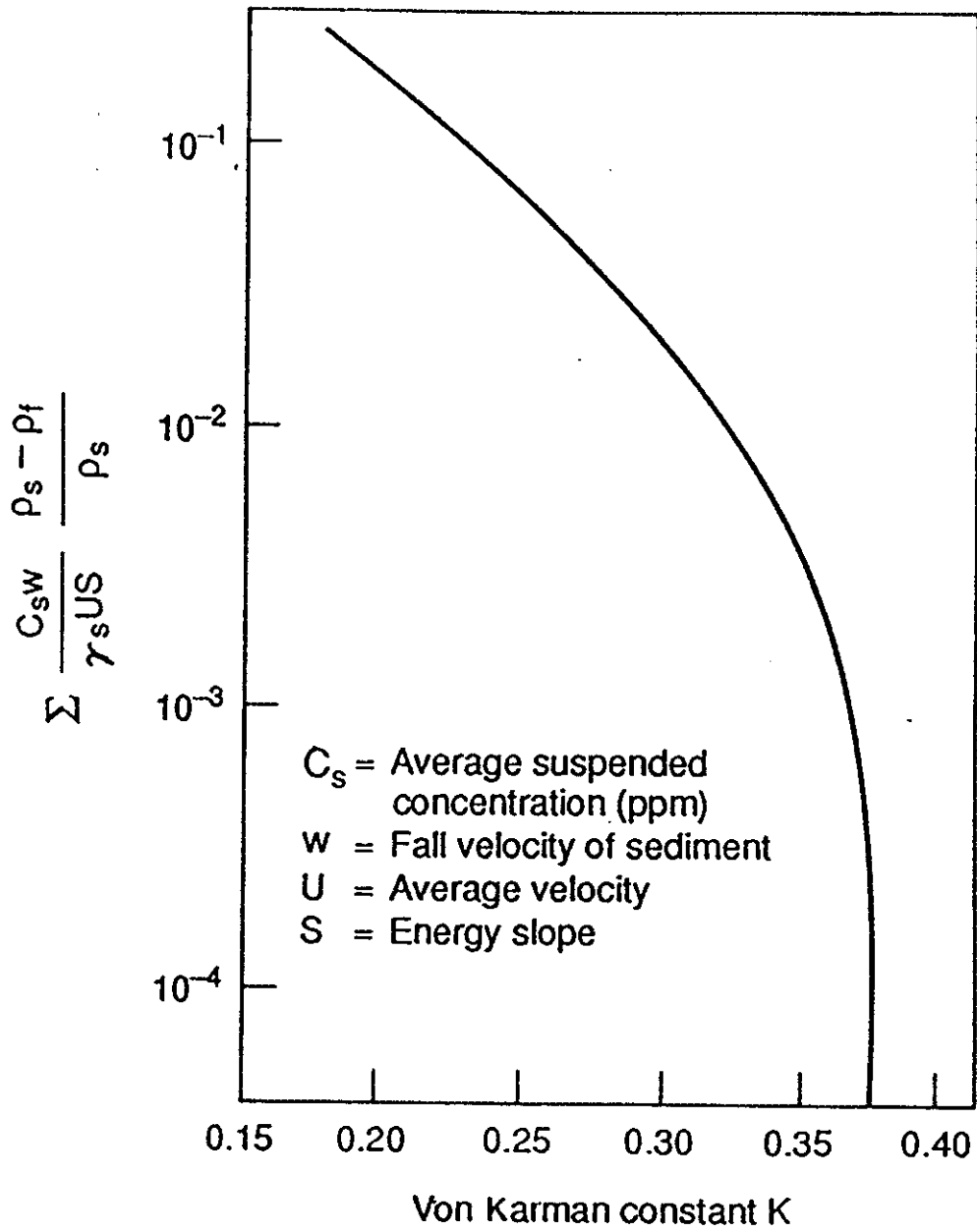
Runoff Peak Flow Adjustments for Urbanization



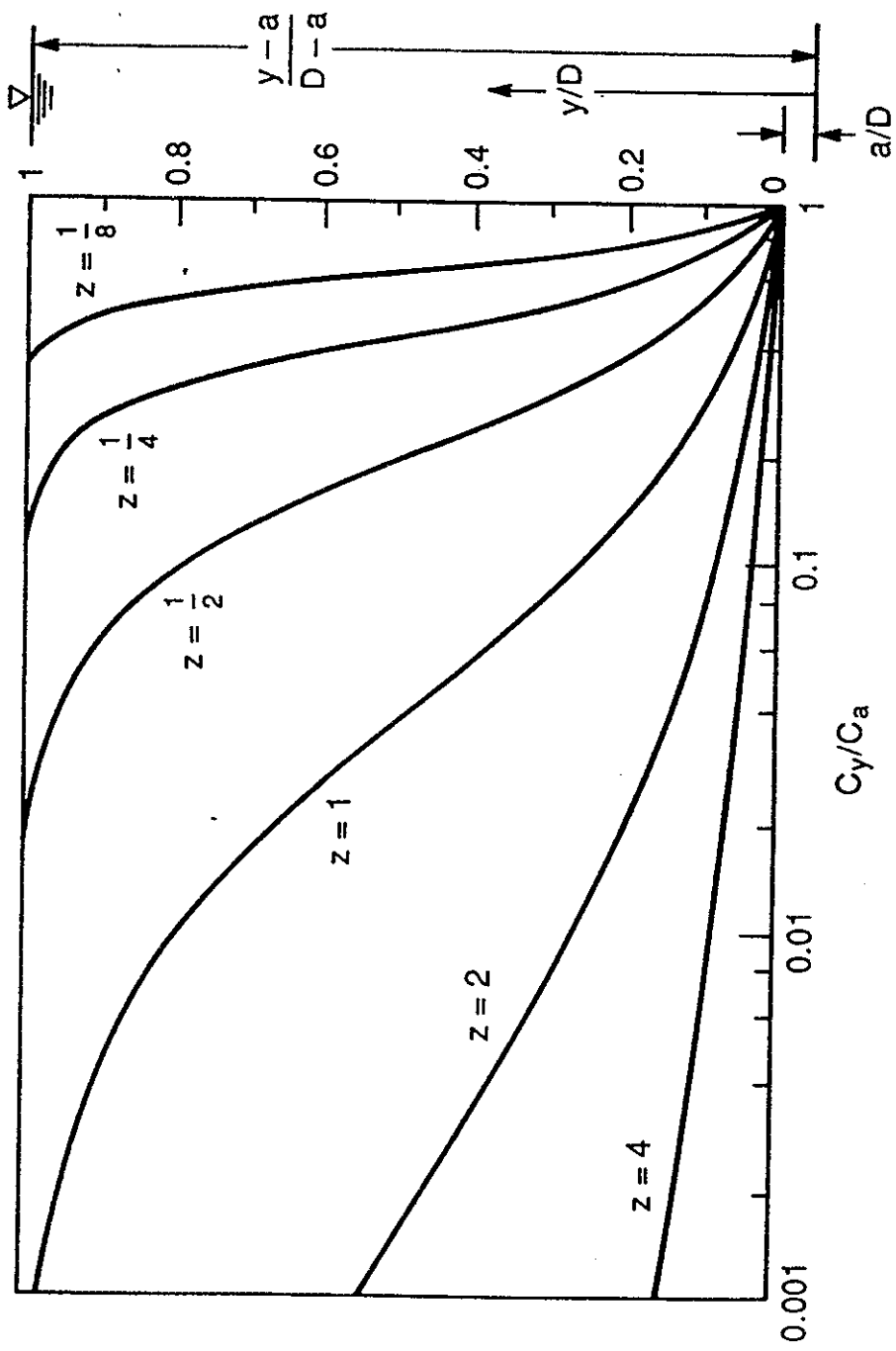
Acid Deposition



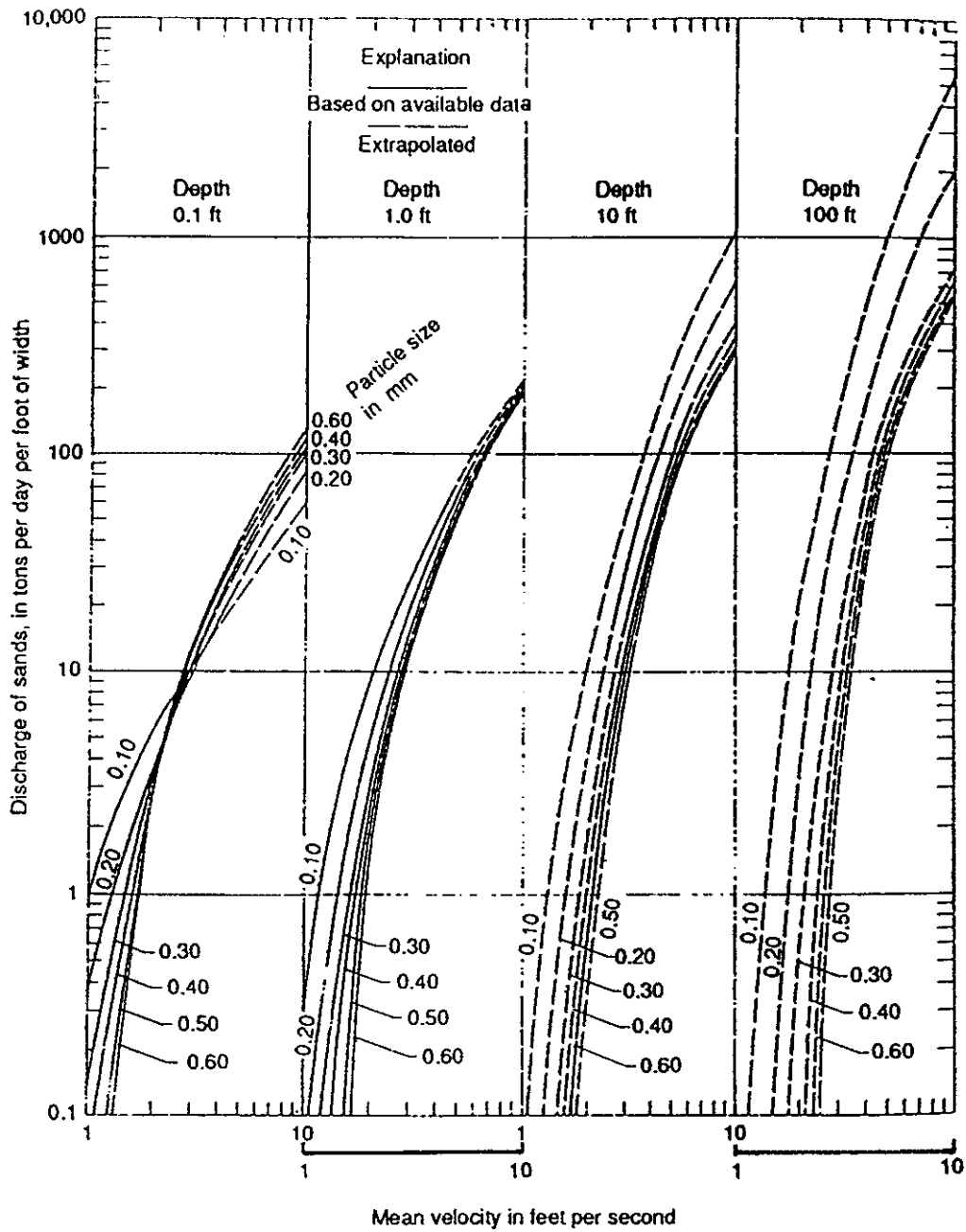
Phosphorus Cycle



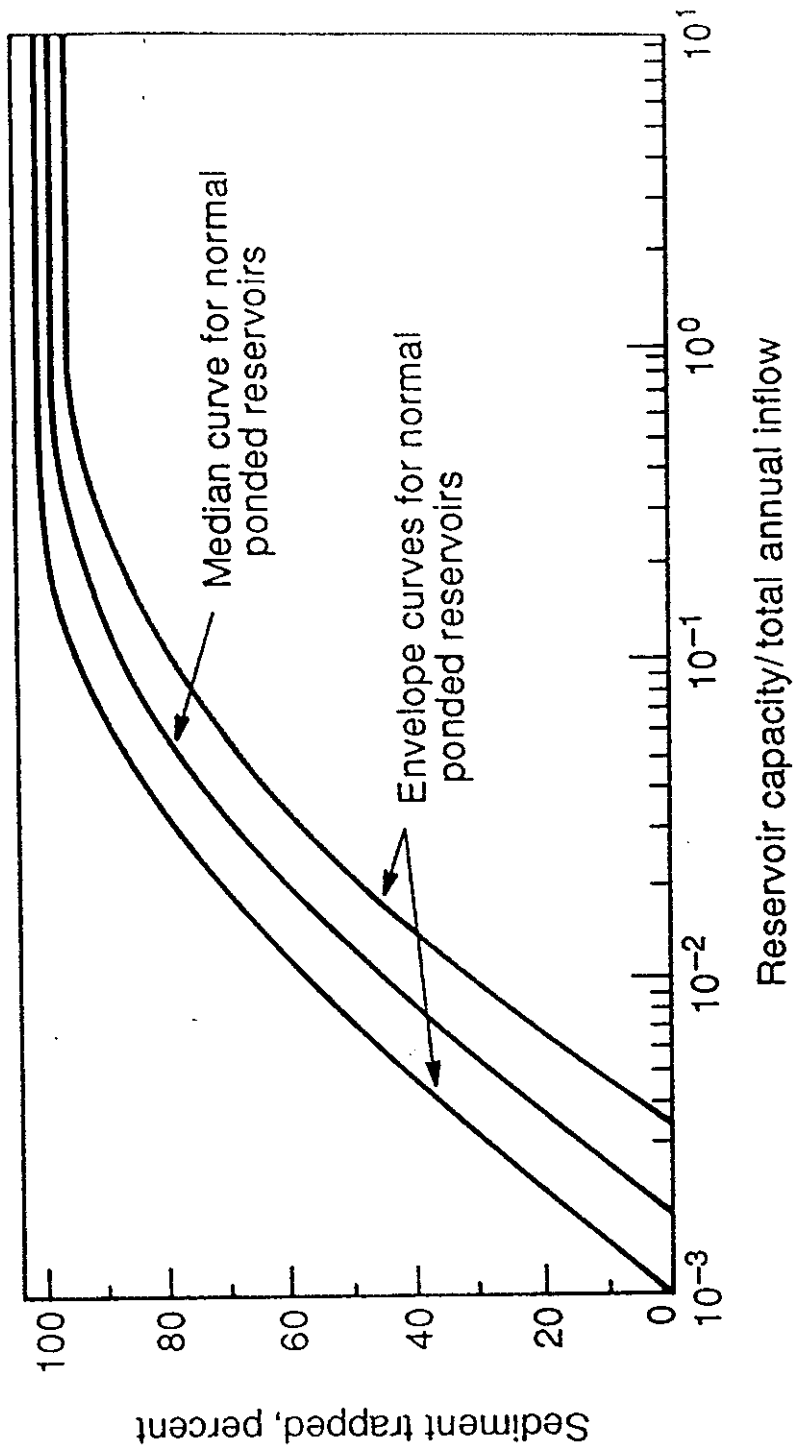
Sediment Concentration Profile



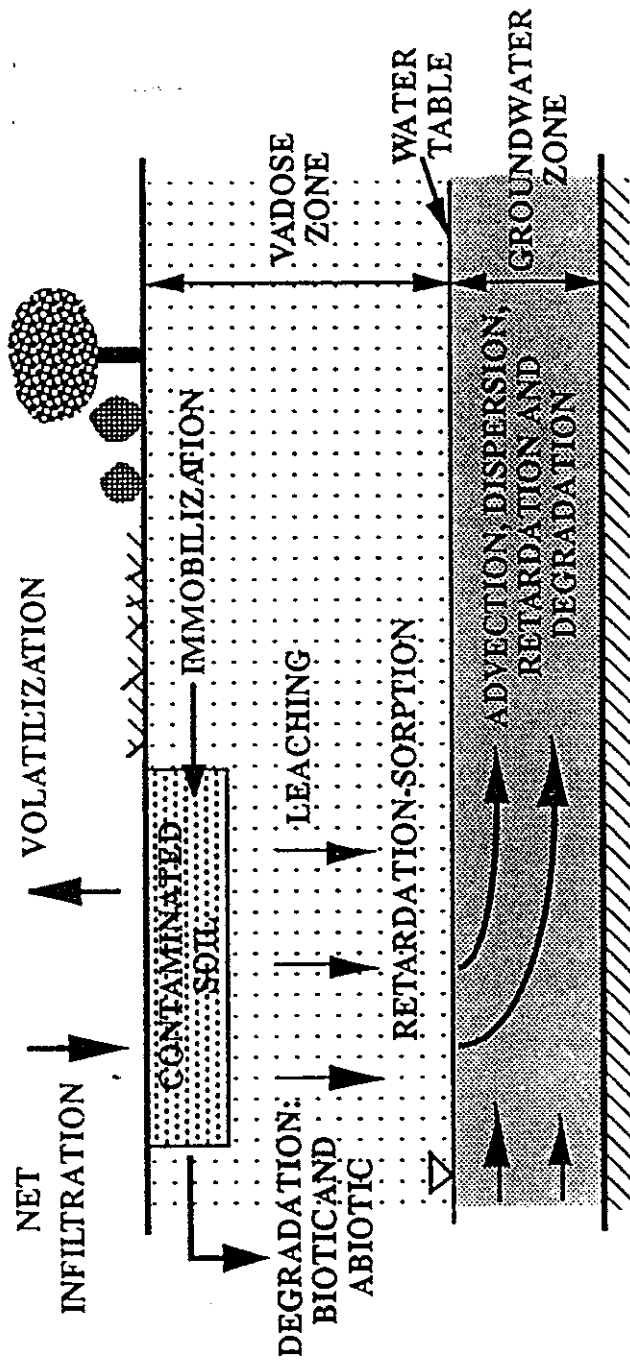
Sediment Concentrations



Example: Sand Discharge versus Flow Velocity



Reservoir Trap Efficiency



Subsurface Flow Contaminant Transport



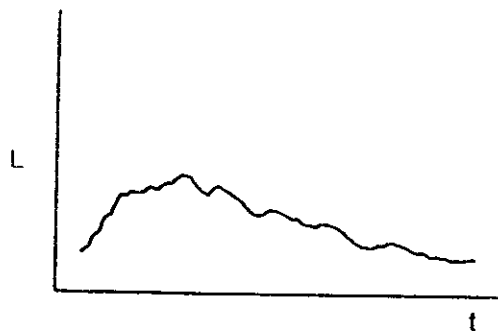
(a) Hydrograph



(b) Pollutograph with constant concentration



(d) Pollutograph with first flush

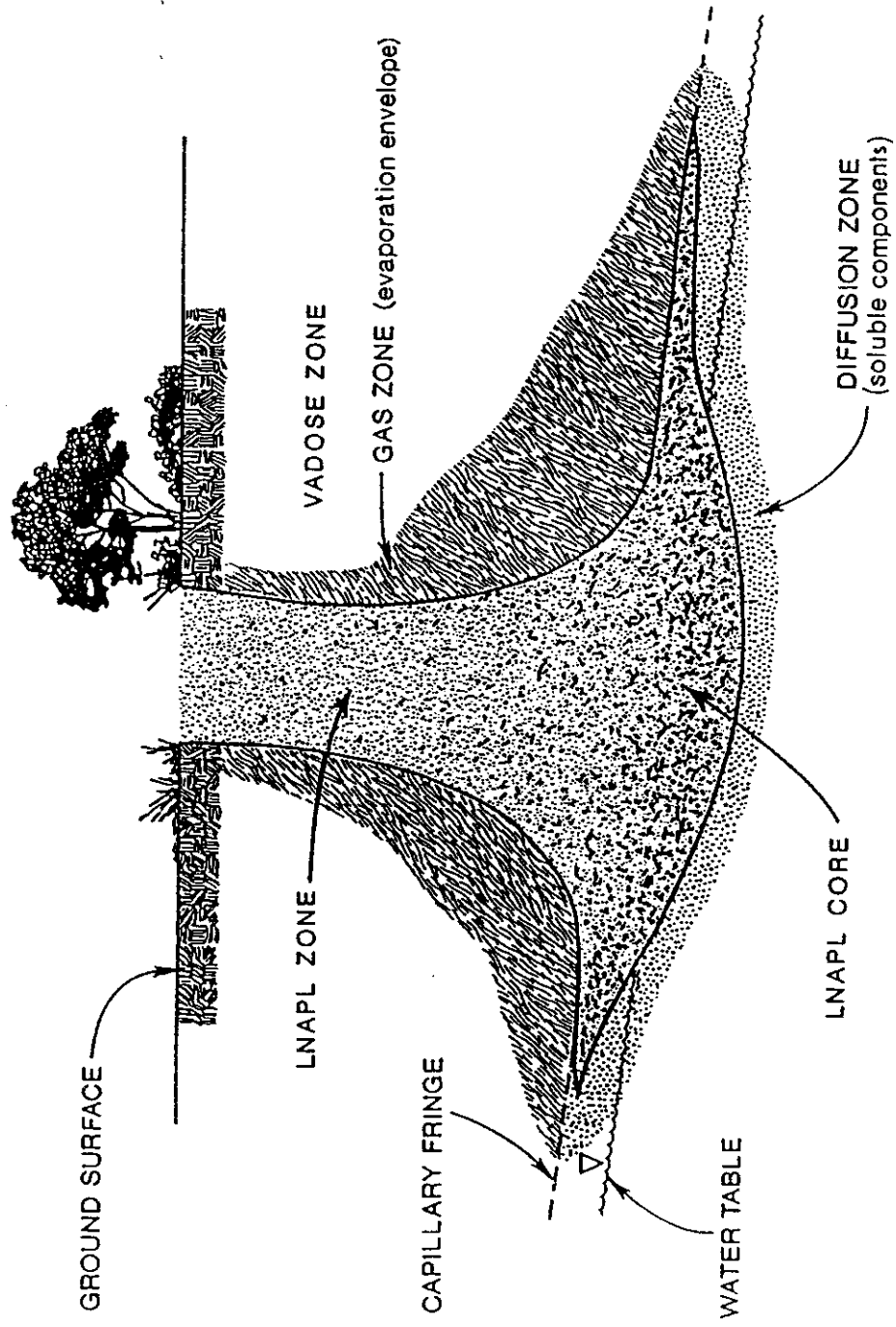


(c) Loadograph ($Q \times C$) for constant concentration



(e) Loadograph ($Q \times C$) for first flush

Urban Surface Water Pollution Mechanics

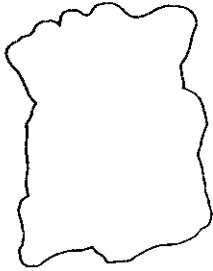


Ground Water Transport

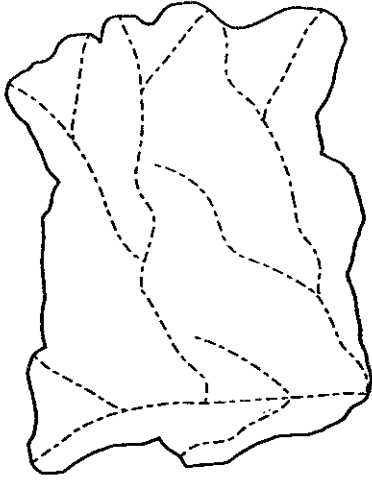
Study Area SC



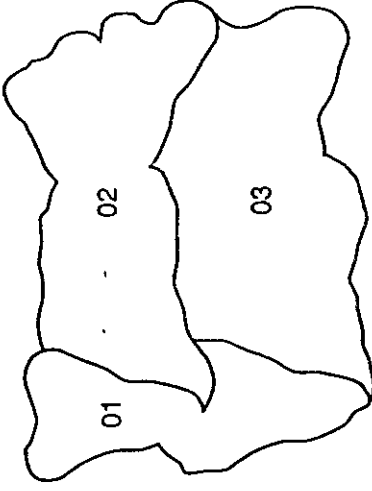
Study Area LA



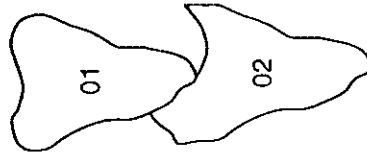
1 Define Study Areas (two-letter ID)



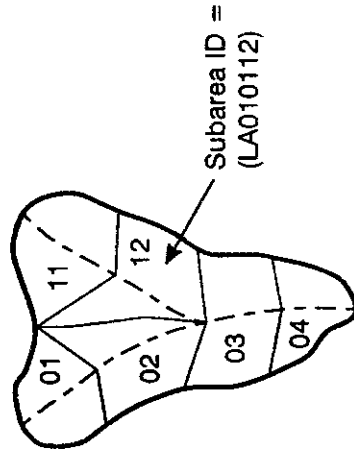
2 Define Major Flowpaths in Study Area



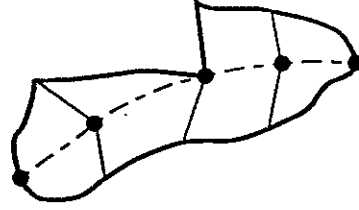
3 Define Regions on Study Area Basis



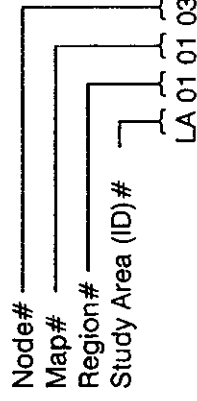
4 Define Maps (or Subregions) on Region Basis



5 Define Model Subareas on Map Basis

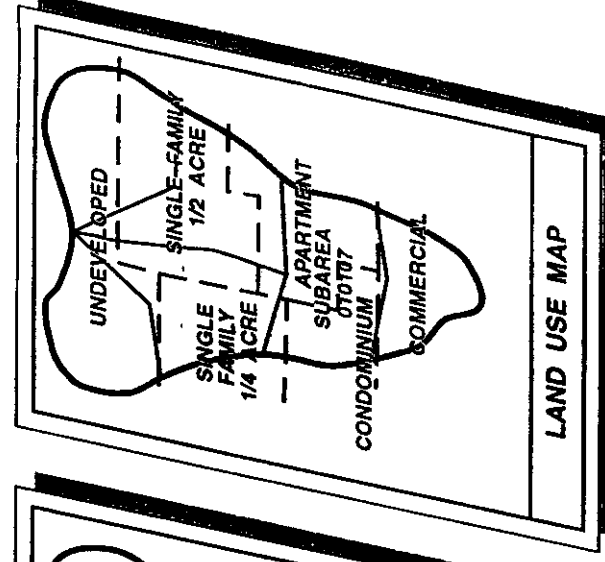
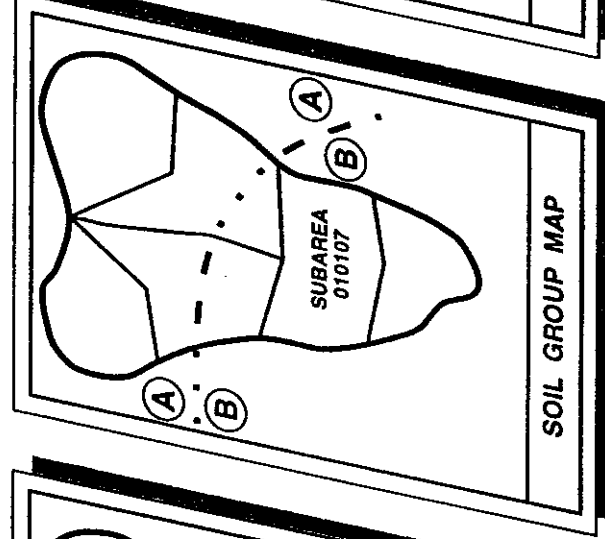
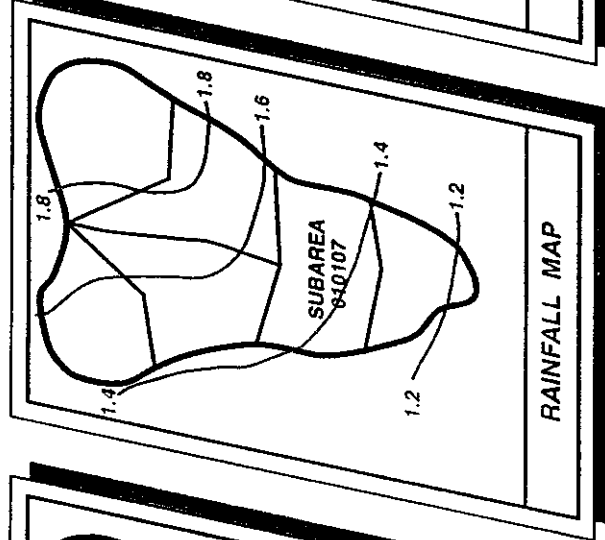
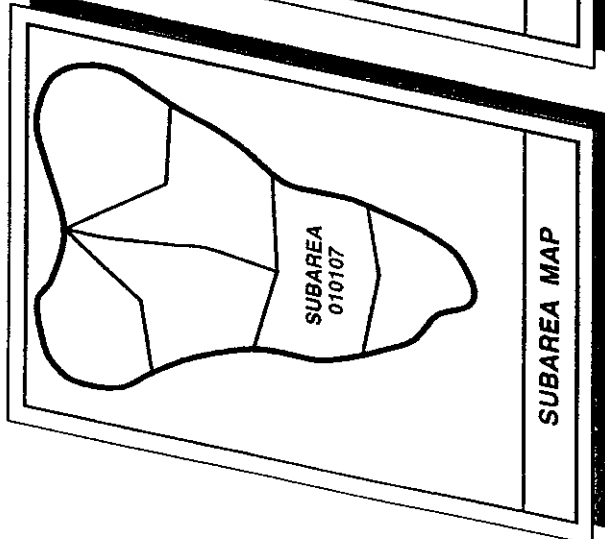


6 Define Model Nodes (Intersection of Subarea Boundaries with Flowpath Lines)



7 Number Nodes

**GIS/Hydrologic Model
Data Base Linkage Setup:
Nodes, Subareas, Links**



GIS Polygon Processing

SUBAREA #010107

| Land Use/Soil Group | A | B | C | D |
|---------------------|-----|-----|-----|-----|
| 1 | ... | 3.0 | ... | ... |
| 2 | ... | 2.5 | ... | ... |
| 3 | ... | ... | 0.7 | ... |
| 4 | ... | ... | 1.3 | ... |
| 5 | ... | ... | ... | ... |

TOTAL AREA = 7.5 ACRES
 SUBAREA RAINFALL DATA:
 5m = 0.3, 30m = 0.5, 1h = 1.0,
 3h = 2.5, 6h = 4.0, 24h = 6.0



Insert into
Global Data Base

**GIS/Parameter Data
Definition for Modeling**

**Hydrologic
Modeling Processes**

STREETFLOW/V-Gutter Flow
(includes midlink and end-of-link hydraulics)



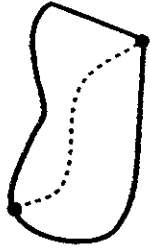
Box/Pipe/Channel
(Existing, Future)



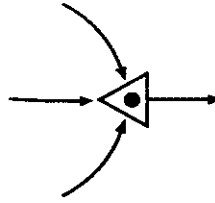
Coupled Street/Pipe
(Deficiency Analysis)



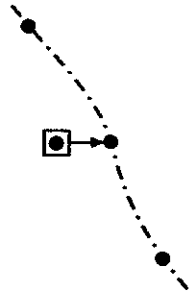
Initial Subarea



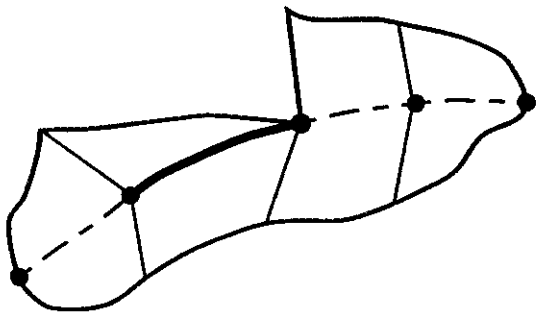
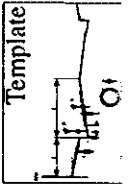
Confluence Analysis
(Peak Flow Rate Table)

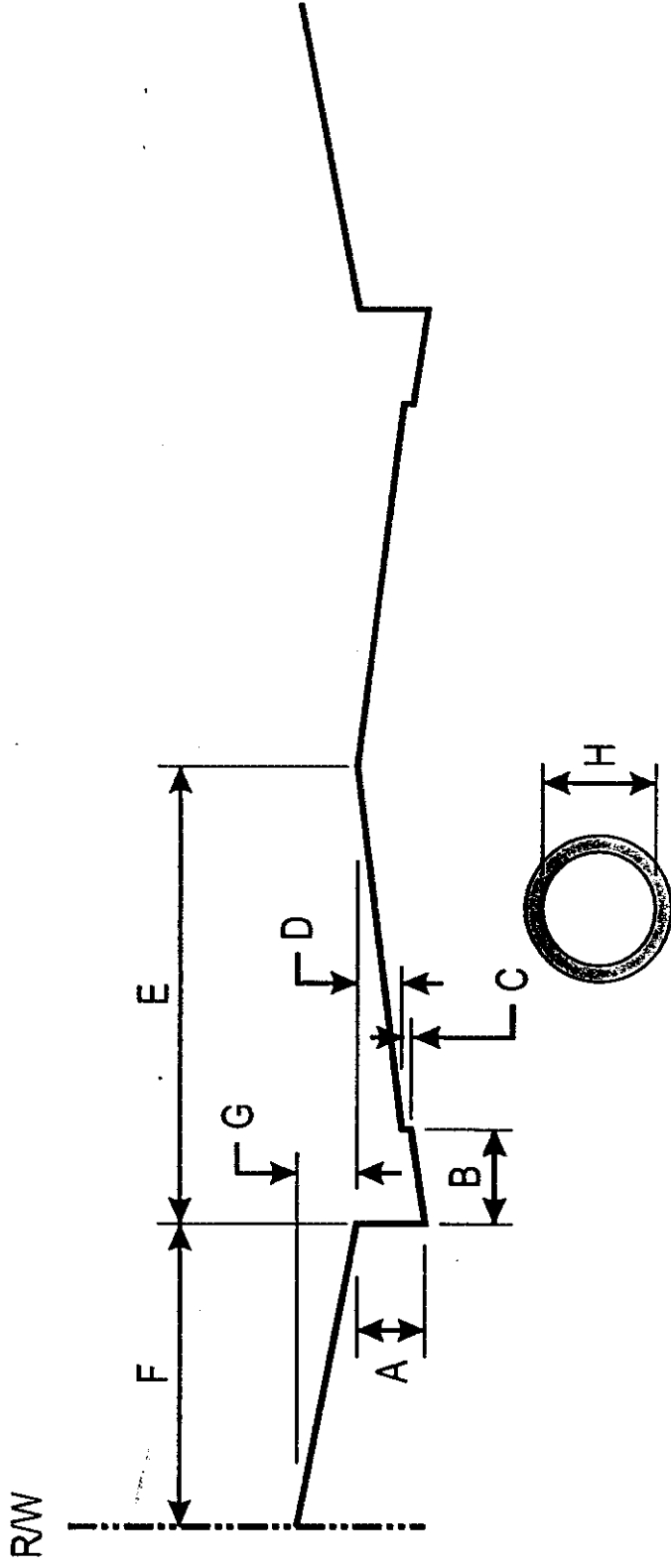


Sourceflow Model
(Flood Control Basins, Pump Stations)



Templates

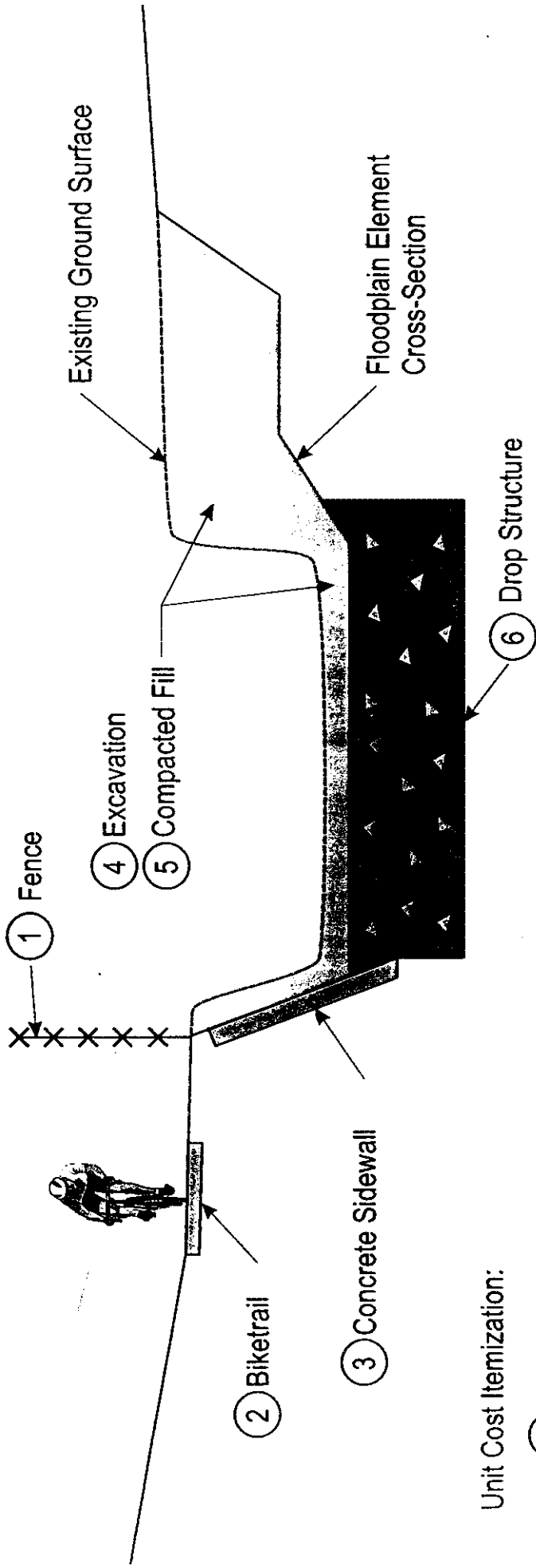




Unit Cost Itemization:

H: Pipe diameter (ft)

System Link Template:
 Type 1: Coupled Streetflow / Pipe
 Model Element (Symmetric)



Unit Cost Itemization:

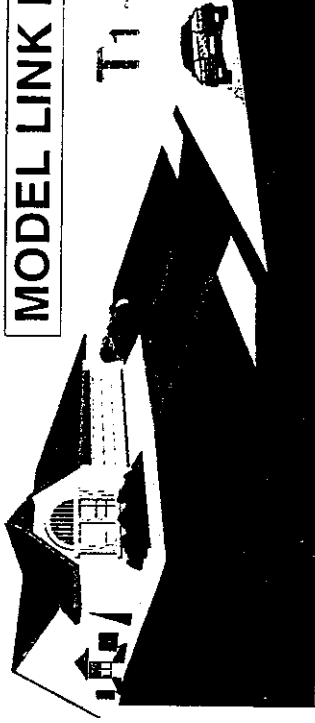
- ① Fence: \$ per unit length (ft)
- ② Biketrail: \$ per unit length (ft)
- ③ Concrete Sidewall: \$ per cubic yard
- ④ Excavation: \$ per cubic yard
- ⑤ Compacted Fill: \$ per cubic yard
- ⑥ Drop Structure: \$ per cubic yard

System Link Template
Type 18: Environmental Channel.

REGULATORY FLOOD PROTECTION GOALS AND EXISTING CAPACITY

MODEL LINK LA021236

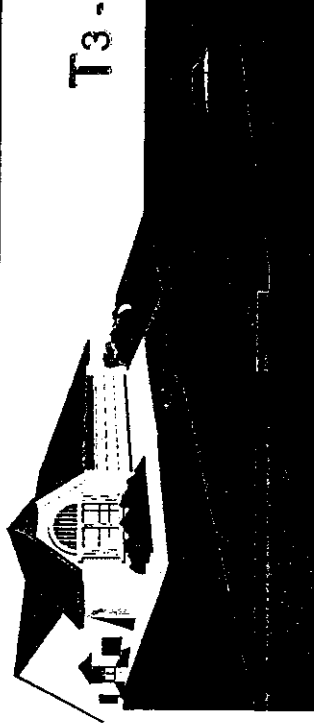
T1 - Year Goal



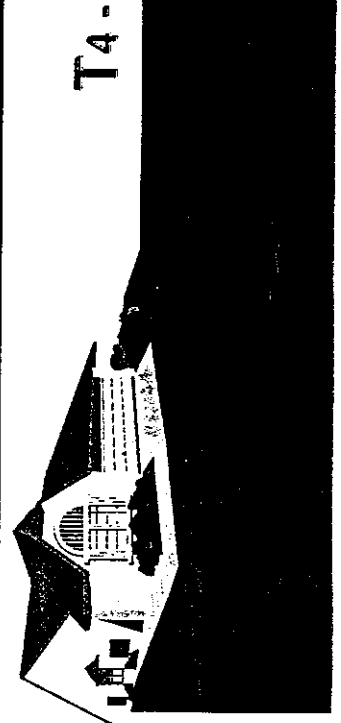
T2 - Year Goal



T3 - Year Goal



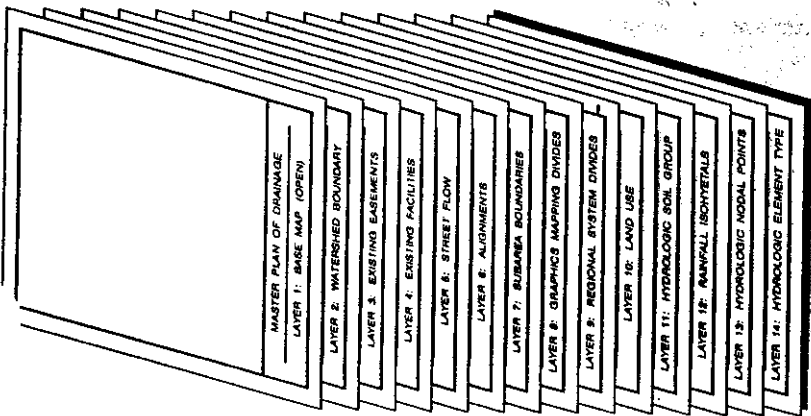
T4 - Year Goal



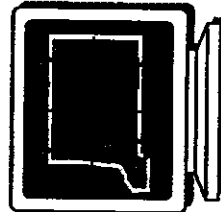
Existing Regulatory Flood Control Capacity

| Storm Frequency | Street Flow | Pipe Flow | TOTAL |
|-----------------|-------------|-----------|-------|
| T1 (10) | 12 | 25 | 37 |
| T2 (25) | 18 | 26 | 44 |
| T3 (50) | 30 | 25 | 55 |
| T4 (100) | 60 | 18 | 78 |

PREPARE DIGITAL GRAPHICS LAYERS



GRAPHICS AND NUMERIC DATA INTEGRATED IN GIS ENVIRONMENT



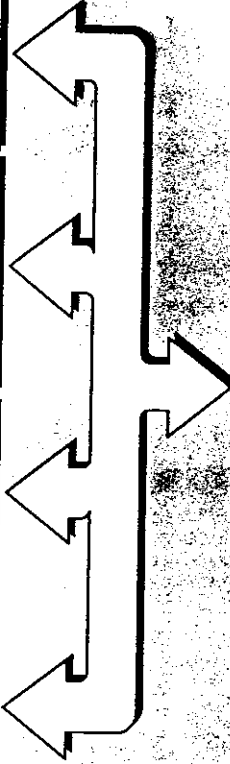
- DELIVERABLE TO AGENCY (GIS APPLICATION)
- DELIVERABLE TO PUBLIC (GRAPHICS DBMS)

Linkage Between GIS Application and Agency Hydrology Standards & Procedures

INTELLIGENT LAYERS DEFINED

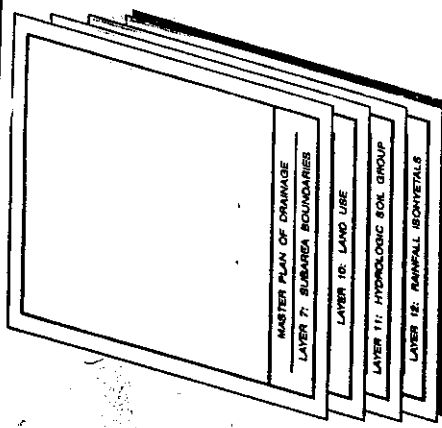


- MANAGEMENT REPORTS
• CAPITAL IMPROVEMENT PROGRAM
- DEFICIENCY ANALYSIS
• HYDRAULICS ANALYSIS
- PRIORITIZATION
• COST ESTIMATES
• COST-TO-BENEFIT INDEXING
- MAPPING
• PLANS & PROFILES
• GRAPHICS

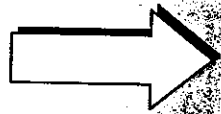


PREPARE COMPUTERIZED MASTER PLAN OF DRAINAGE

- AES MASTER PLANNING SOFTWARE
 - System Analysis
 - Deficiency Analysis
 - Unit Hydrograph Method
 - Rational Method
 - Link-File
 - Generation 3 Master Planning Features
 - NPDES Pollutant Projections



POLYGON PROCESSING PREPARES AUTOMATICALLY HYDROLOGIC DATA INPUT

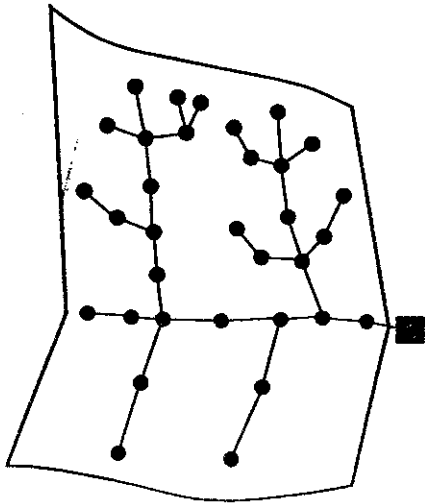


SUBAREA #025


| Land Use/Soil Group | A | B | C | D |
|---------------------|-----|-----|-----|-----|
| 1 | 3.0 | ... | ... | ... |
| 2 | 2.5 | ... | ... | ... |
| 3 | ... | ... | 2.0 | ... |
| 4 | ... | ... | ... | ... |
| 5 | ... | ... | ... | ... |

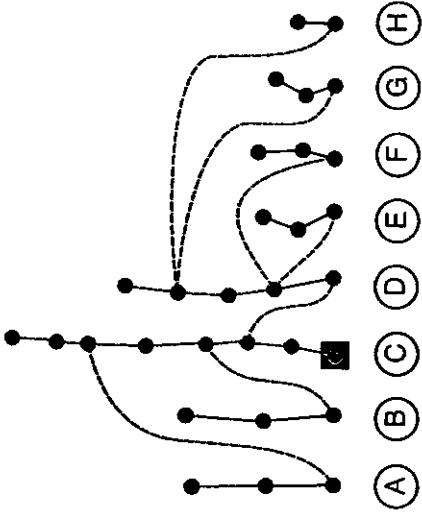
TOTAL AREA = 7.5 ACRES
 SUBAREA RAINFALL DATA:
 5m = 0.3, 30m = 0.5, 1h = 1.0
 3h = 2.5, 6h = 4.0, 24h = 6.0

Agency Hydrology Standards & Procedures




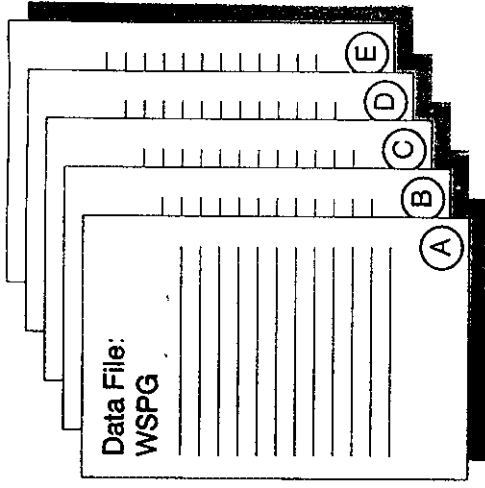
1. Define Hydraulic Controls at  Locations

 AES: String Finder Program



2. Resolve Network into Strings (Automated Links Noted as -----)

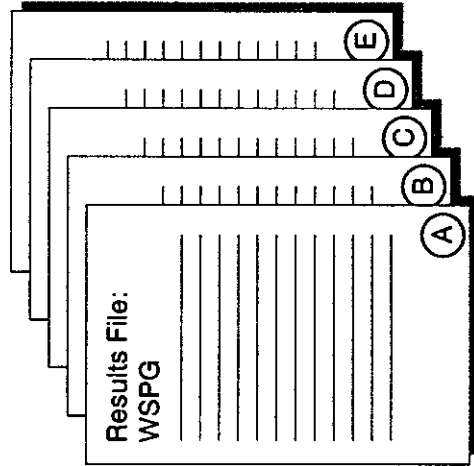
 AES: Hydraulics "Setup" Program



3. Setup Program "Storm Plus", or "WSPG", or HEC-2 Data Files



4. Run Hydraulics Programs




5. Read Hydraulics Results on a Model Node & Link Basis, and Insert into Global Data Base


| Node No. | Topo Elev. | HGL Elev. | V (fps) | V Clearance (ft.) |
|----------|------------|-----------|---------|-------------------|
| 18 | 104.0 | 102.5 | 6.9 | 1.5 |
| 19 | 103.0 | 101.0 | 7.2 | 2.0 |
| 20 | 102.5 | 100.8 | 7.3 | 0.7 |
| ... | ... | ... | ... | ... |

AES: Automated Hydraulics Model Analysis

LEGEND

- Node
- Link
-  CBI Magnitude

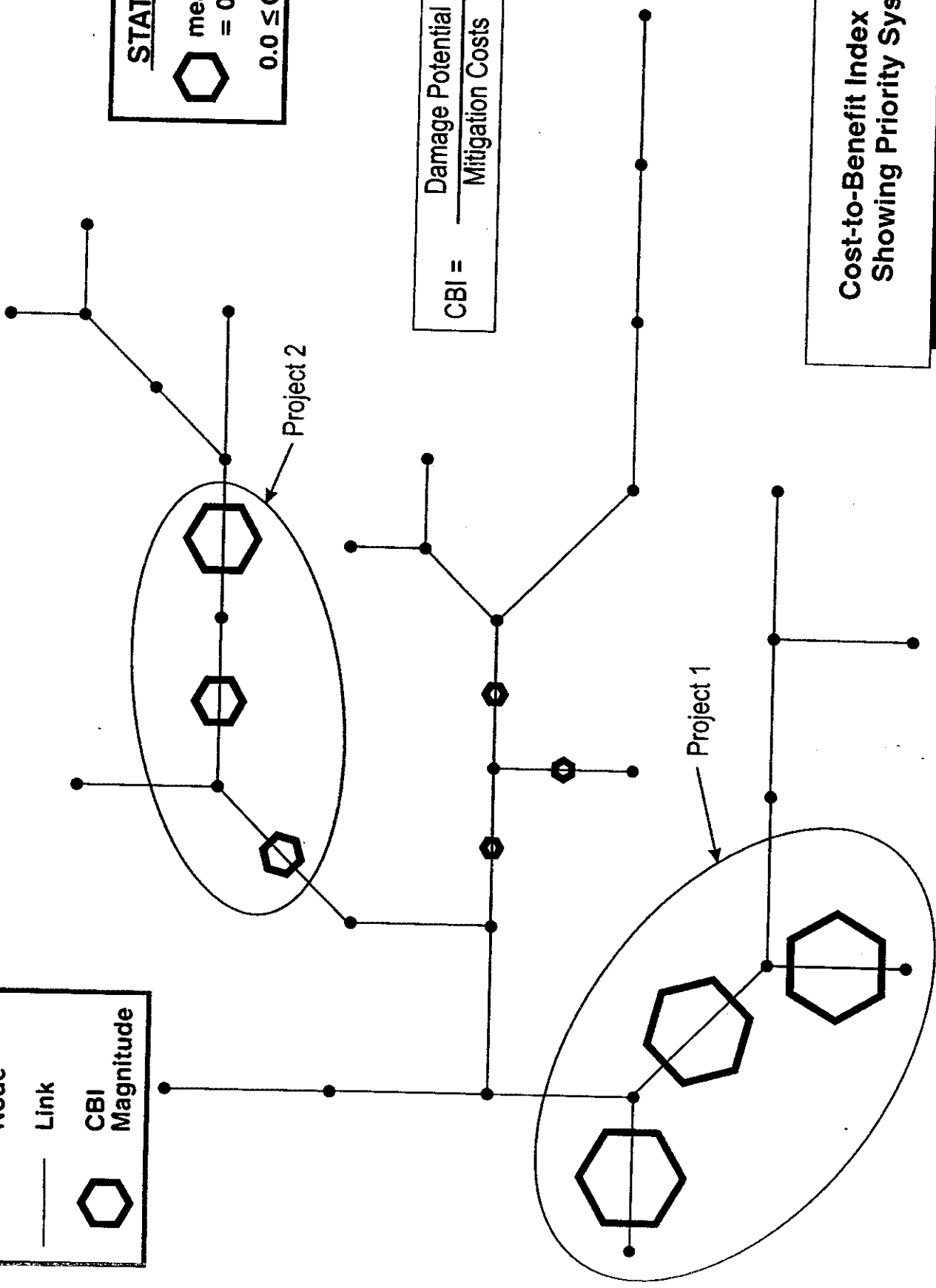
STATISTICS

 mean CBI value = 0.22

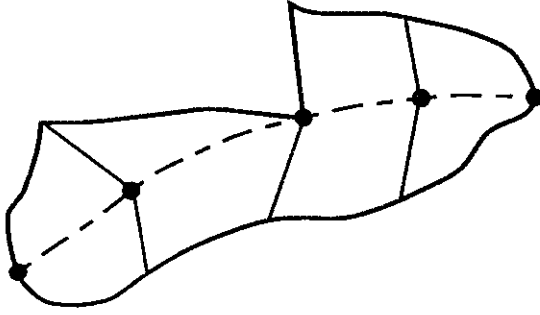
$0.0 \leq \text{CBI} \leq 1.0$

$$\text{CBI} = \frac{\text{Damage Potential}}{\text{Mitigation Costs}}$$

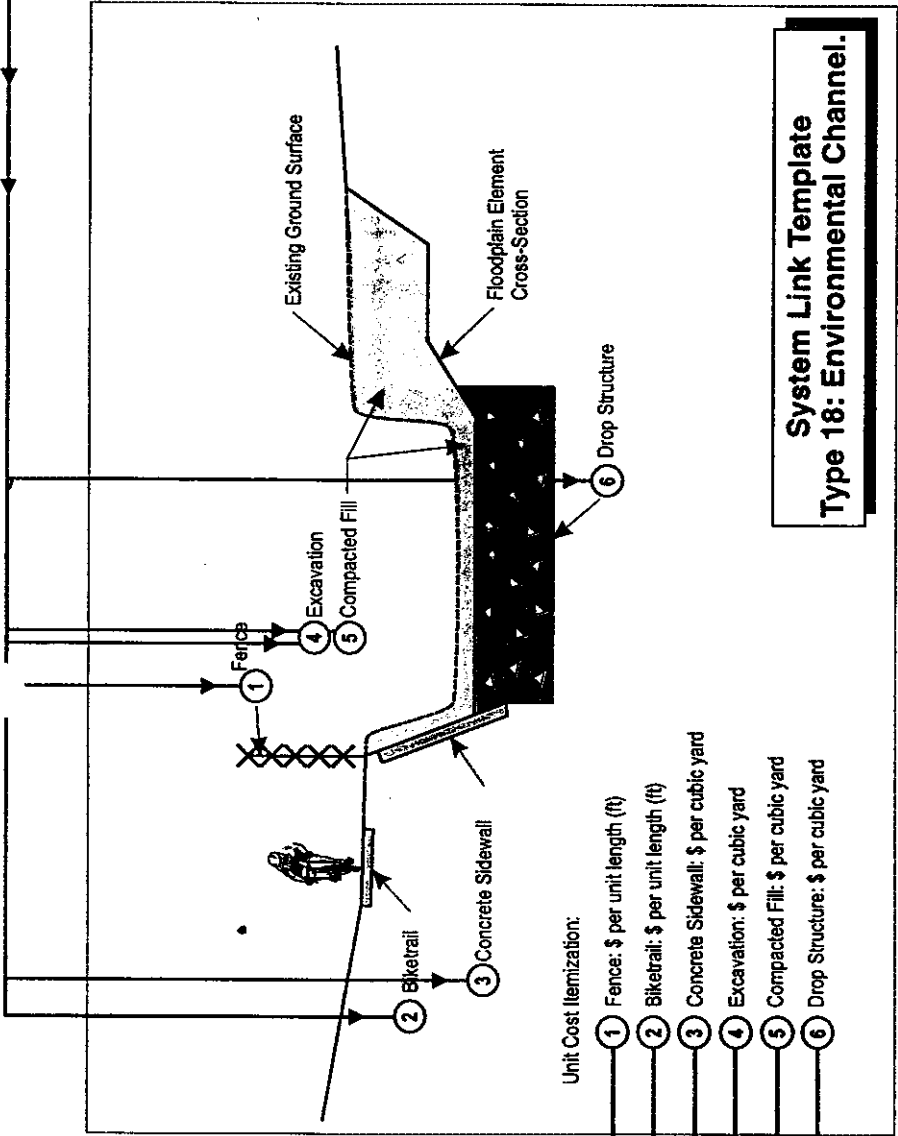
Cost-to-Benefit Index Display Showing Priority Systems.



For each link...



LINK DATA BASE

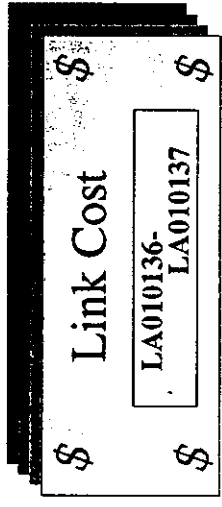


System Link Template
Type 18: Environmental Channel.

Unit Cost Itemization:

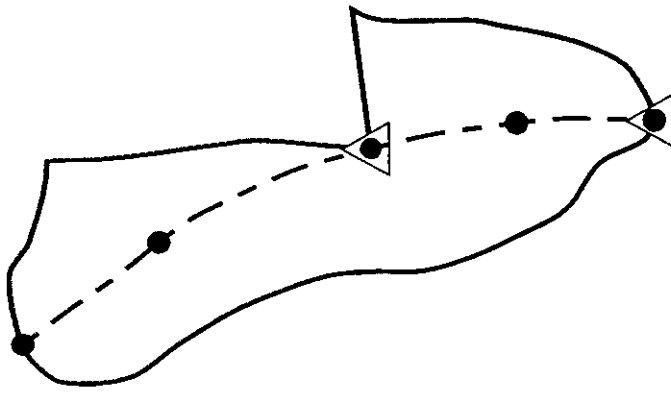
- 1 Fence: \$ per unit length (ft)
- 2 Biketrail: \$ per unit length (ft)
- 3 Concrete Sidewall: \$ per cubic yard
- 4 Excavation: \$ per cubic yard
- 5 Compacted Fill: \$ per cubic yard
- 6 Drop Structure: \$ per cubic yard

UNIT COST DATA BASE



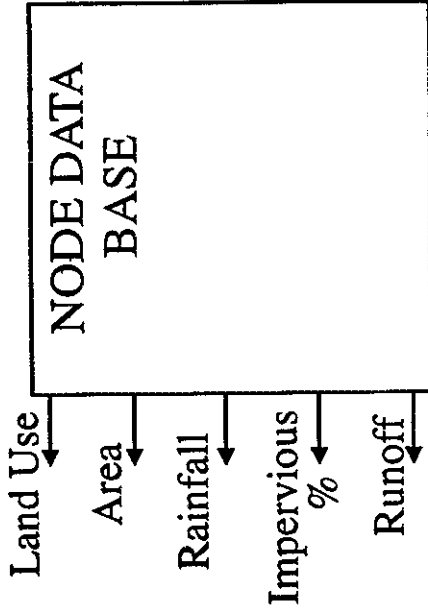
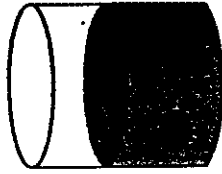
Cost Estimation and Impact Evaluation

For targetted Nodes...

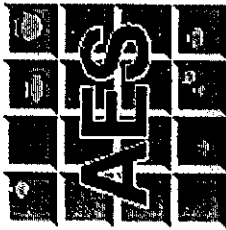


- BOD
- COD
- TSS
- TDS
- NO₂, NO₃
- TKN
- Pb
- Zinc
- Cu
- Cadmium
- Total P
- Dissolved P

| |
|--|
| Event Mean Concentration (EMC) Data Base |
| Monitoring Data |



**Annual Pollutant
Loading Estimates**



- HydroSoft
- HEC-Series
- SIMS
- gis/Interface
- License
- Information
- Exit

GIS: Geographic Information Systems

Prepare Digital
Elevation Data

Intelligent Data
Definition

Polygon Processing
Automatically Prepares
Hydrologic Data Input

TABLE 1: Results of
Population Forecasting

SUBAREA 12

| Lead Use/Build Group | A | B | C | D |
|----------------------|-----|-----|-----|-----|
| 1 | 30 | 23 | ... | ... |
| 2 | ... | ... | 30 | ... |
| 3 | ... | ... | ... | ... |
| 4 | ... | ... | ... | ... |

TOTAL AREA 12
SUBAREA 12: 2,200,000 sq. ft., 10
mi. x 200 mi. x 200 mi. x 10

Model

Run

Stop

Cancel

Help

Supplied to Users
Data and Reports

Report
Output
Reports

Print Reports, Tables
and Summary
Reports

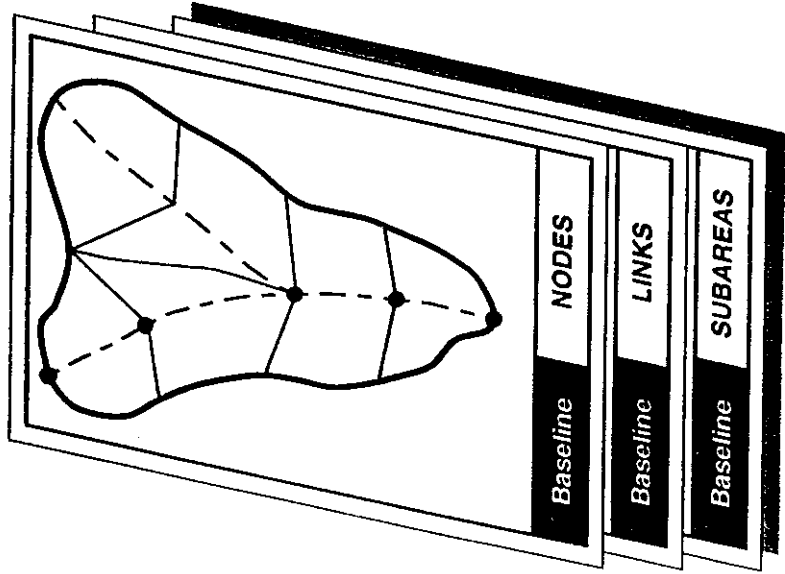
Print Reports, Tables
and Summary
Reports

Prepare Hydrologic
and Stormwater
Computer Models

Print Reports, Tables
and Summary
Reports

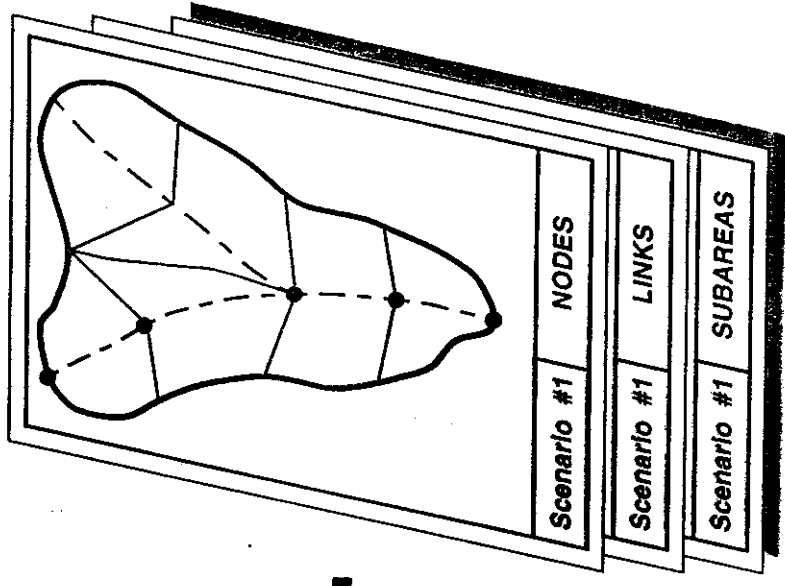
Print Reports, Tables
and Summary
Reports

Public
Agency
Criteria



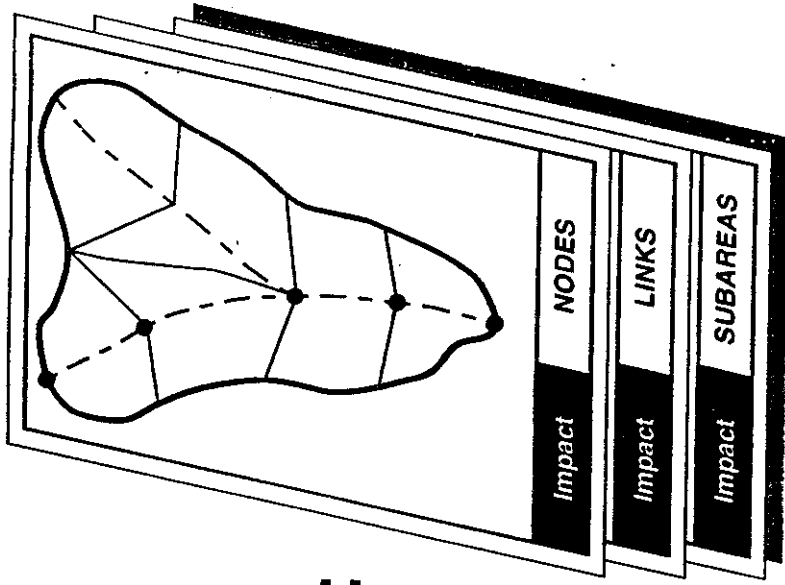
Baseline Data Base (adopted MPD)

-



Scenario 1 Data Base

=



Baseline - Scenario 1 Data Base

- Total impacts seen... focus entire MPD towards "what if" scenario test.
- "Adopt" Scenario if approved.
- Store changes in AES "Historian".

MPD Impact Analysis