

A Dynamic Monitoring Program -- Turkey Creek Watershed (Colorado) Case Study

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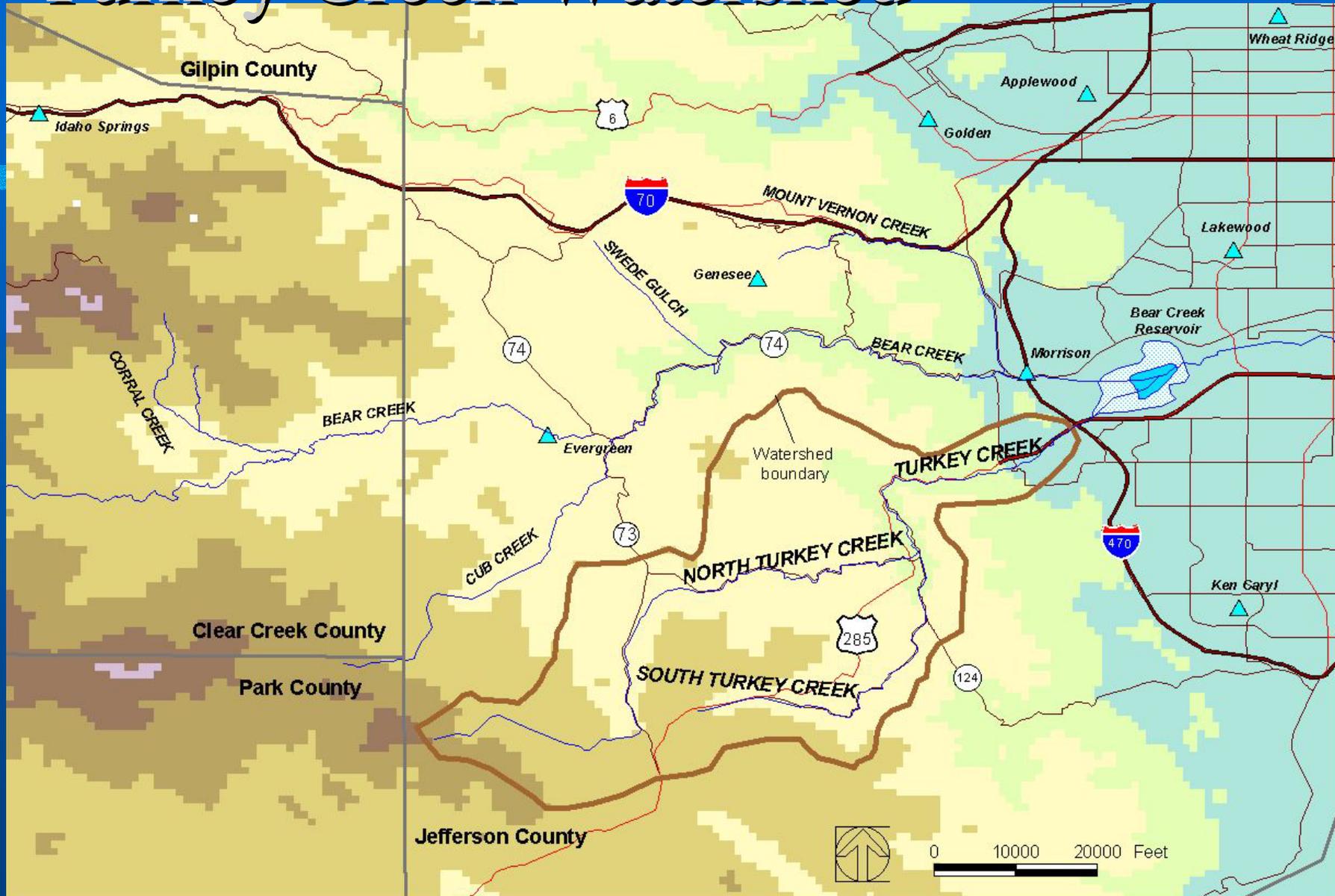
In Association with

*Michael W. Crouse, Clear Creek Consultants and
Theresa Tiehen, Colorado Dept. of Transportation*

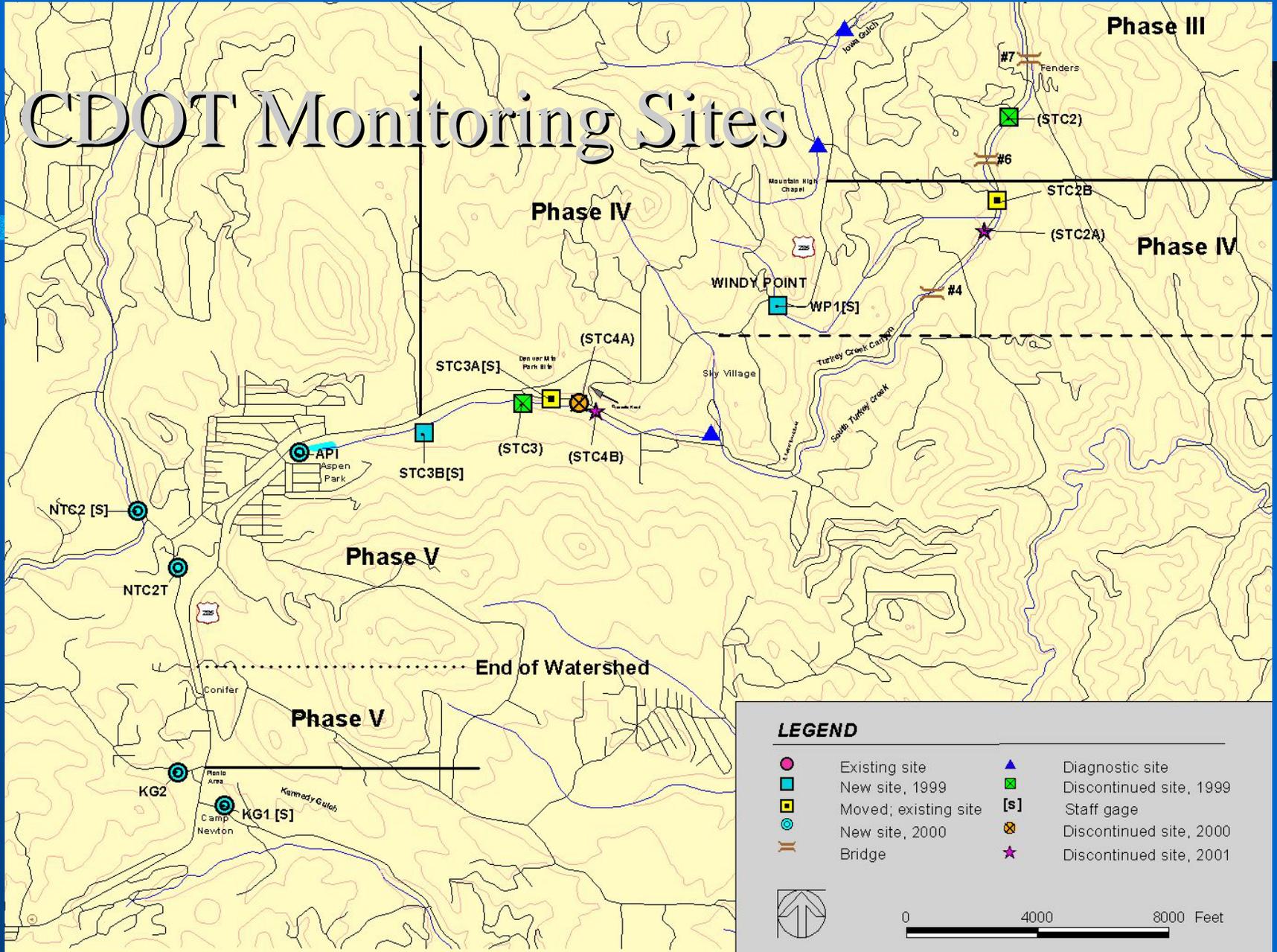
Presentation Outline

- **Physical setting and historical perspective**
- **Summary of 1999-2003 surface-water quality monitoring-program results**
- **Overview of observational aspects**
- **Watershed impacts; implementation of BMPs and effectiveness**
- **Coordination with stakeholders**
- **Discussion and questions**

Turkey Creek Watershed



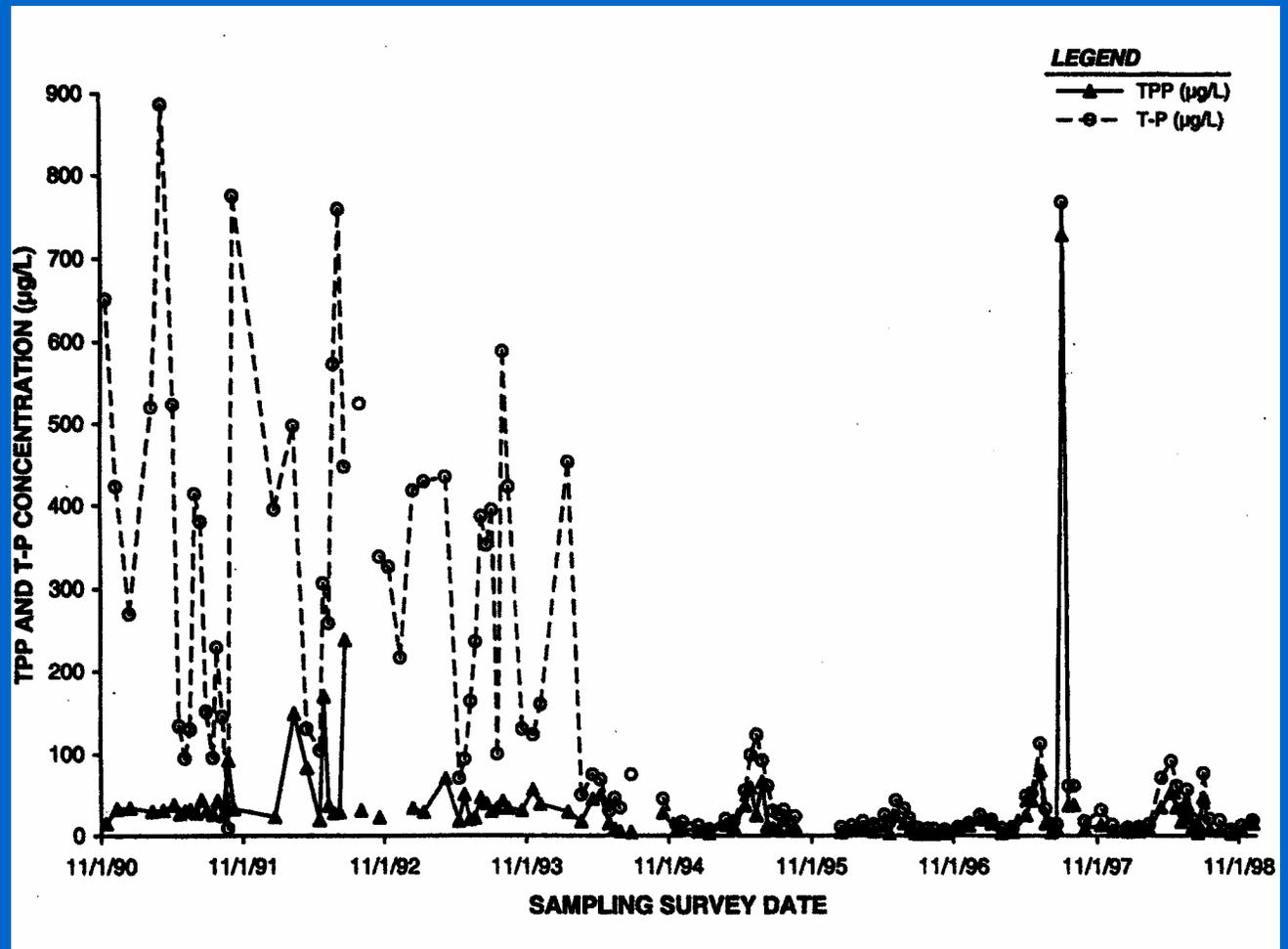
CDOT Monitoring Sites



Background and Setting

- Fall of 1990, start of DRCOG-WE monitoring of Bear Creek Res. inflows
- Beginning in 1995, CDOT supplemental monitoring in upper Turkey Creek
- Beginning in 1999, significant monitoring-program changes (paired-site concept)
- During 1999-2003, a *dynamic* water-quality monitoring program (year-to-year changes); program ended in 2003

Historical T-P Time-Series, Site TCIN



What do we mean by dynamic?

- Annual review of monitoring-site selection
- Scheduling of monthly/storm-event surveys
- Intermittent evaluation of water-quality variables
 - *Erosion/construction related*
 - *Nutrient species (Bear Creek Res. control reg.)*
 - *Field measurements & physical characteristics*

Streamflows are measured or estimated at time of sample collection

See 1999-2003 Annual Reports

Monitoring-Program Aspects

Annual modifications in water-quality network operations

- Sites: shifting “upstream”, since 1999
- Frequency/scheduling: essentially same
- Monthly versus supplemental events
- Variables: flows; some WQ reductions

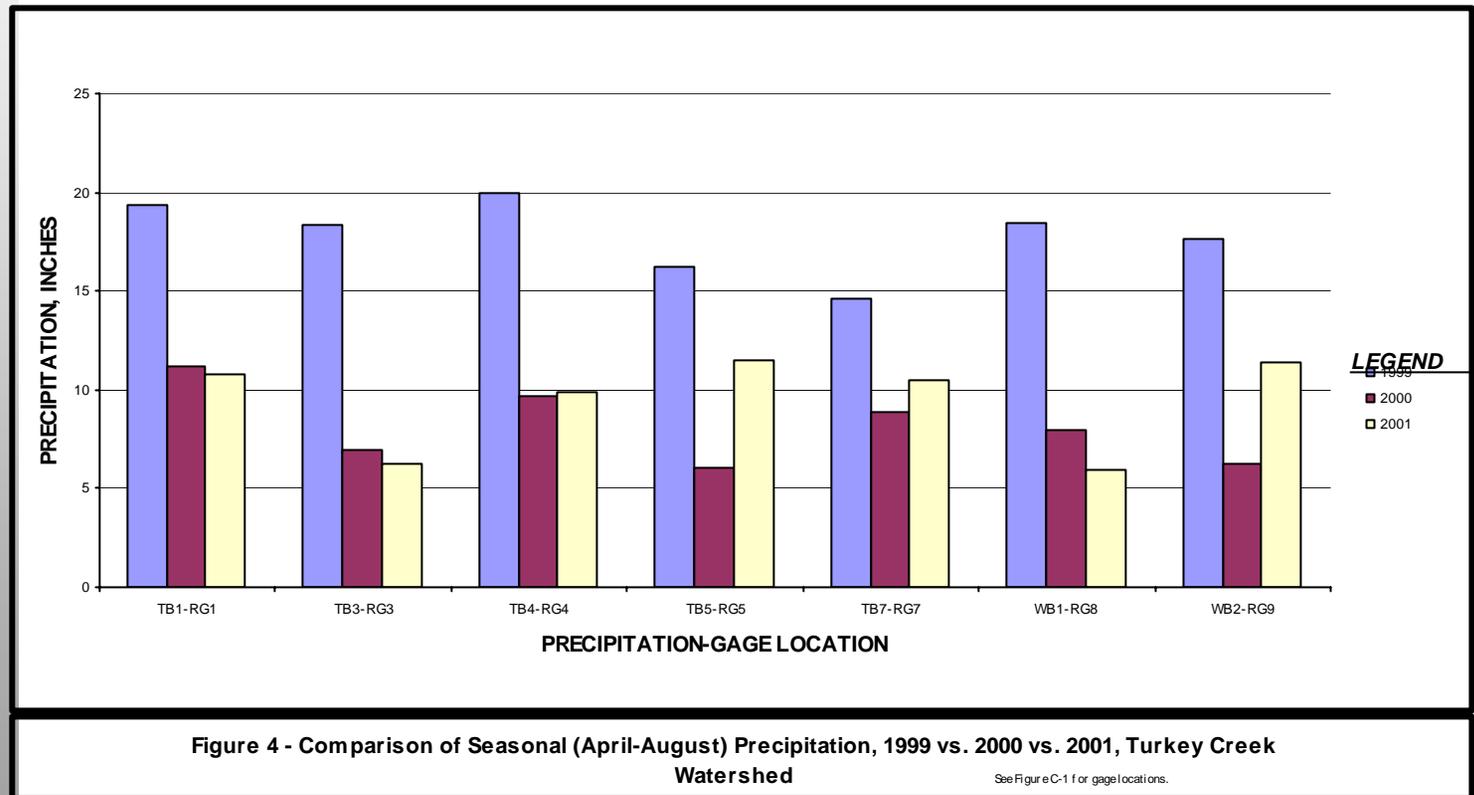
Graphical display of data – time series

Information, not merely data!

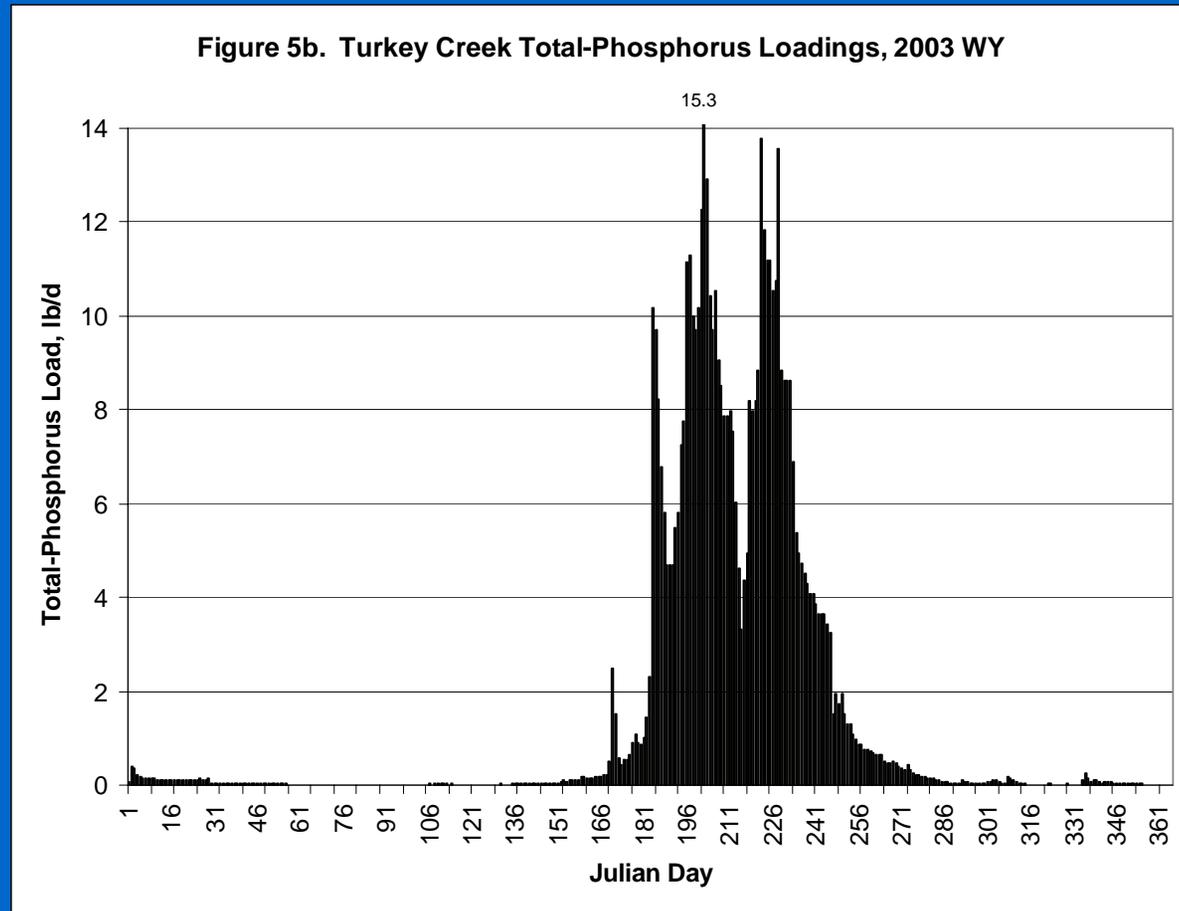
1999-2003 Monitoring-Program Components

- **Sampling Sites to Monitor Construction**
- ***Paired (Upstream vs. Downstream)***
- **Blend – Routine vs. Event Monitoring**
- **Year-to-Year Variability – Qs & WQ**
- **Linkages with Other Data Sources**
(USGS GW study; BCWA-WE program)
- **Field Observations/Share with CDOT Project Engineers – *Reactions to Conditions***

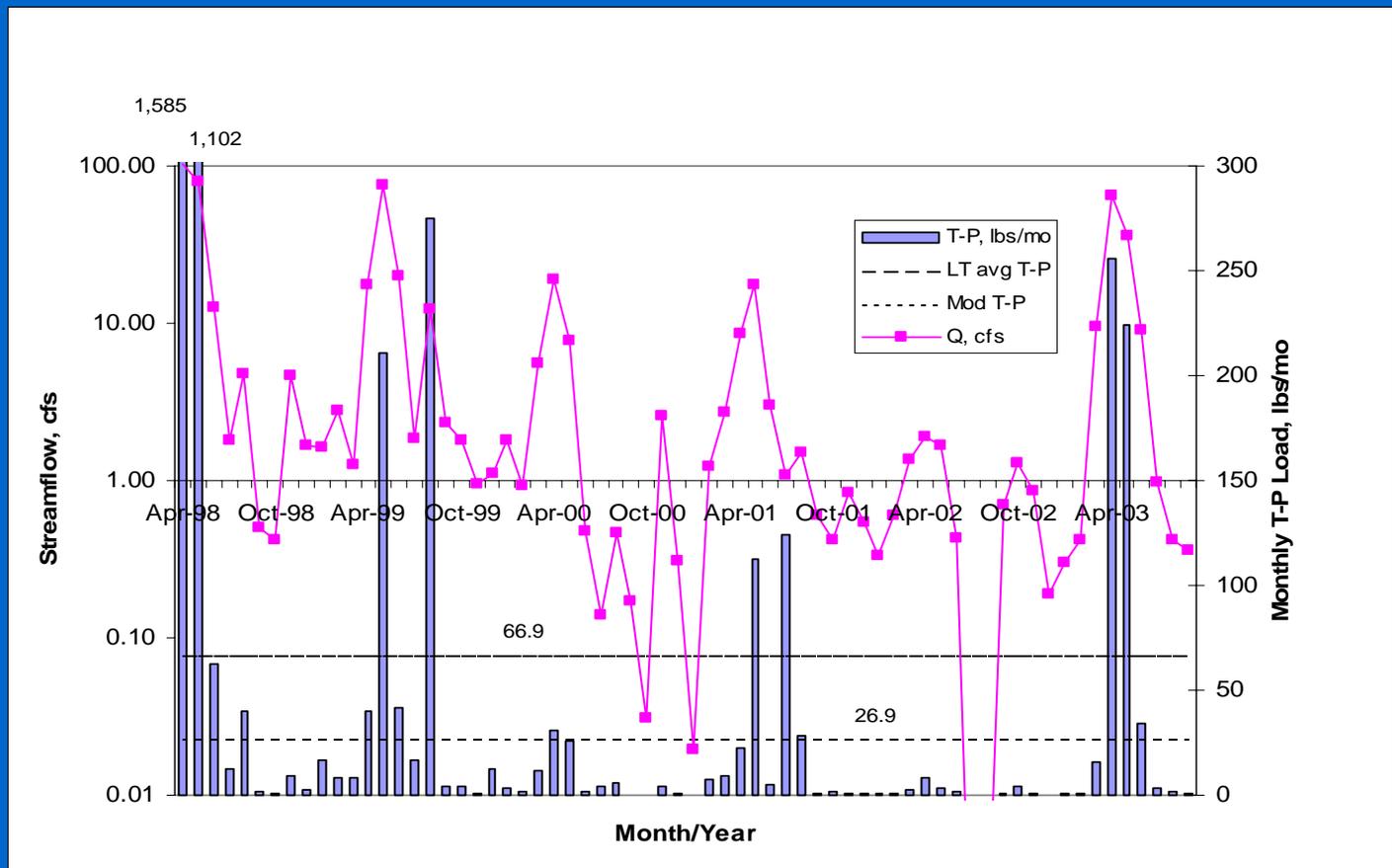
Comparison of Seasonal Precipitation: 1999 vs. 2000 vs. 2001 (April-August)



Total-Phosphorus Loadings, 2003 WY



Monthly Total-Phosphorus Loads, 1998-2003



Estimated T-P Loads (lbs/y)

<u>Period</u>	<u>T-P Load</u>	<u>Source</u>
1990-95	2,800	DRCOG-Historical
1998 CY	1,821	DRCOG, 1998-1999
1998 (6)	2,804	Exponent-TDS
1999 CY	634	Exponent-TDS
2000 CY	103	Exponent-TDS
2001 CY	315	Exponent-TDS
2002 CY	20 [14.3]	Exponent-TDS/BCWA
2003 CY	542	TDS

Nutrient-Related Conditions (*important to Bear Creek Reservoir Control Regulation*)

- **Nitrate-Nitrogen (NO₃-N)**
 - Comparable -- historical/recent periods
- **Total Phosphorus (T-P)**
 - Comparable -- historical/recent periods
- **Ammonia-Nitrogen (NH₃-N) – site TC2**
 - Increases since 2000, due to higher detection limit

– Also Time-Series Plots of:

Temperature & Specific Conductance (salinity)
Sediment-Related Variables (TSS, turbidity)

[Note: See 2003 Annual Report Appendix B time-series figures]

North Turkey Creek at STC Confluence, Ortho-Phosphorus and Total Phosphorus Concentrations

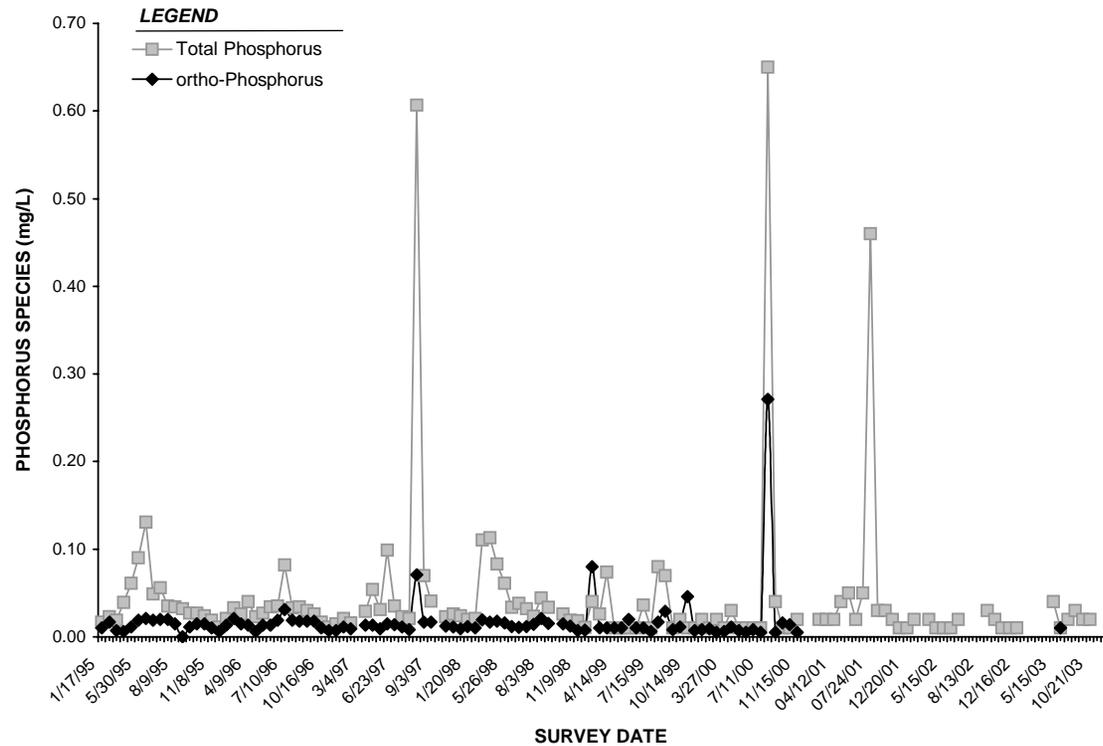
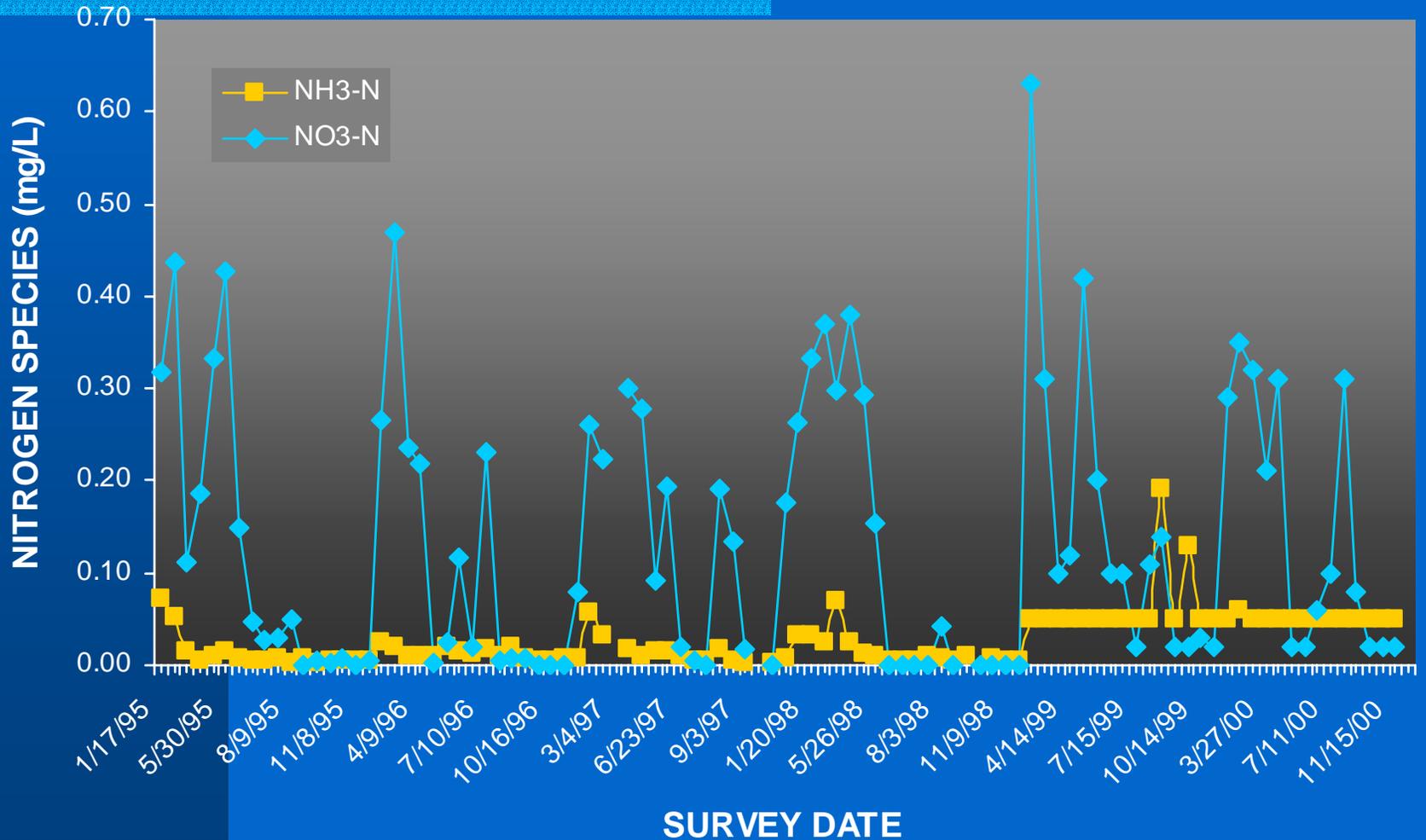


Figure B-4b. North Turkey Creek at South Turkey Creek confluence (NTC1/NTC1A), total phosphorus and ortho-phosphate

North Turkey Creek at South Turkey Creek Confluence, NH₃-N and NO₃-N



Turkey Creek near Willow Springs Development, Ortho-Phosphorus & Total-P Concentrations

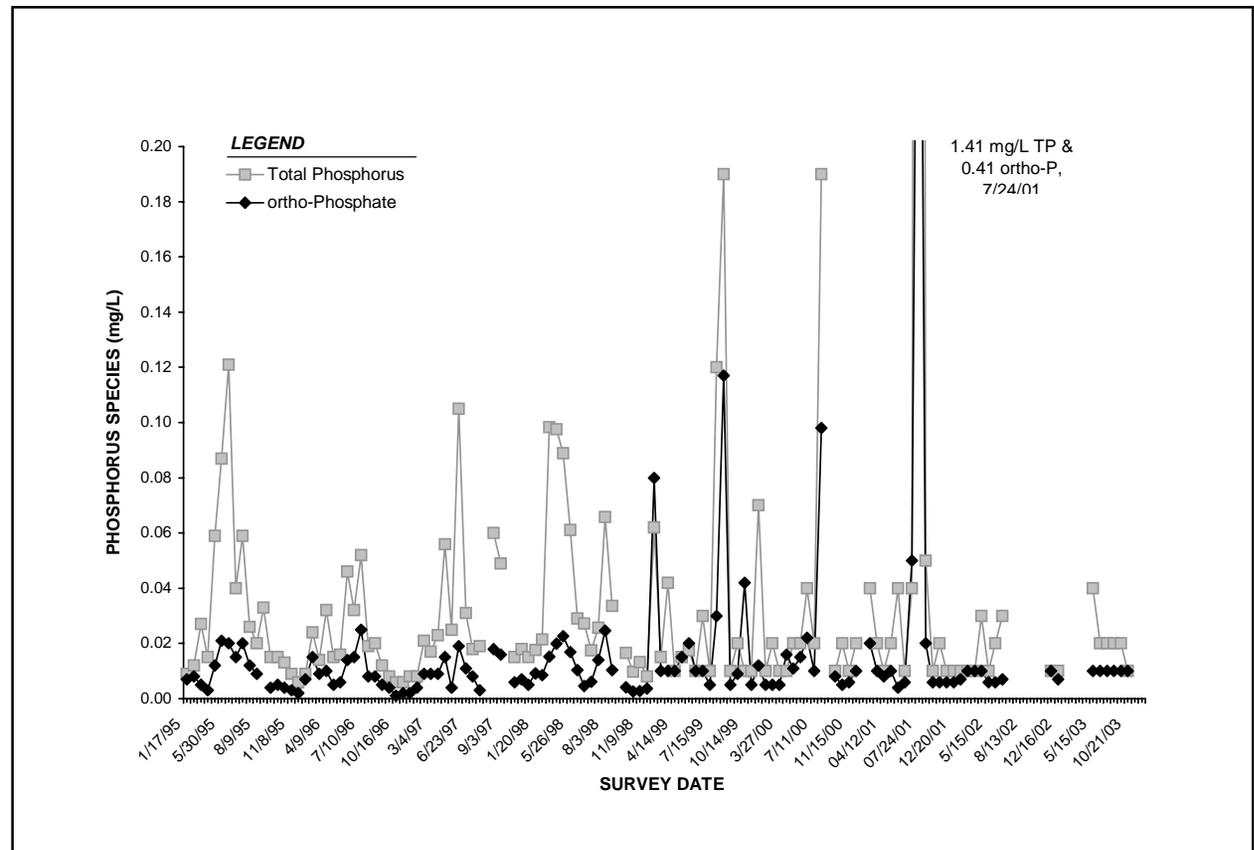


Figure B-6b. Turkey Creek below Parmalee Gulch (TC2/TC2A), total phosphorus and ortho-phosphate

Effectiveness of BMPs – Phase V

- **Field observations: consultations with CDOT field personnel**
 - Upper South Turkey Creek (STC3B/A)
 - Aspen Park/Conifer areas (AP1)
 - Kennedy Gulch intersection (KG2/KG1)
 - Windy Point area (WP1)
- **Photographs – documentation and follow-through; information dissemination**

Kennedy Gulch Intersection



CDOT Sedimentation Basins – Kennedy Gulch Area



In-Channel Pole Footing Construction



Aspen Park CDOT Sedimentation Basin (above Site AP1), 5/15/03



CDOT Post-Storm-Event Maintenance



Tributary, Upper North Turkey Creek



Iron-Oxide Precipitation, Windy Point Area -- 2003



Land-Development Impacts Stream Sediments

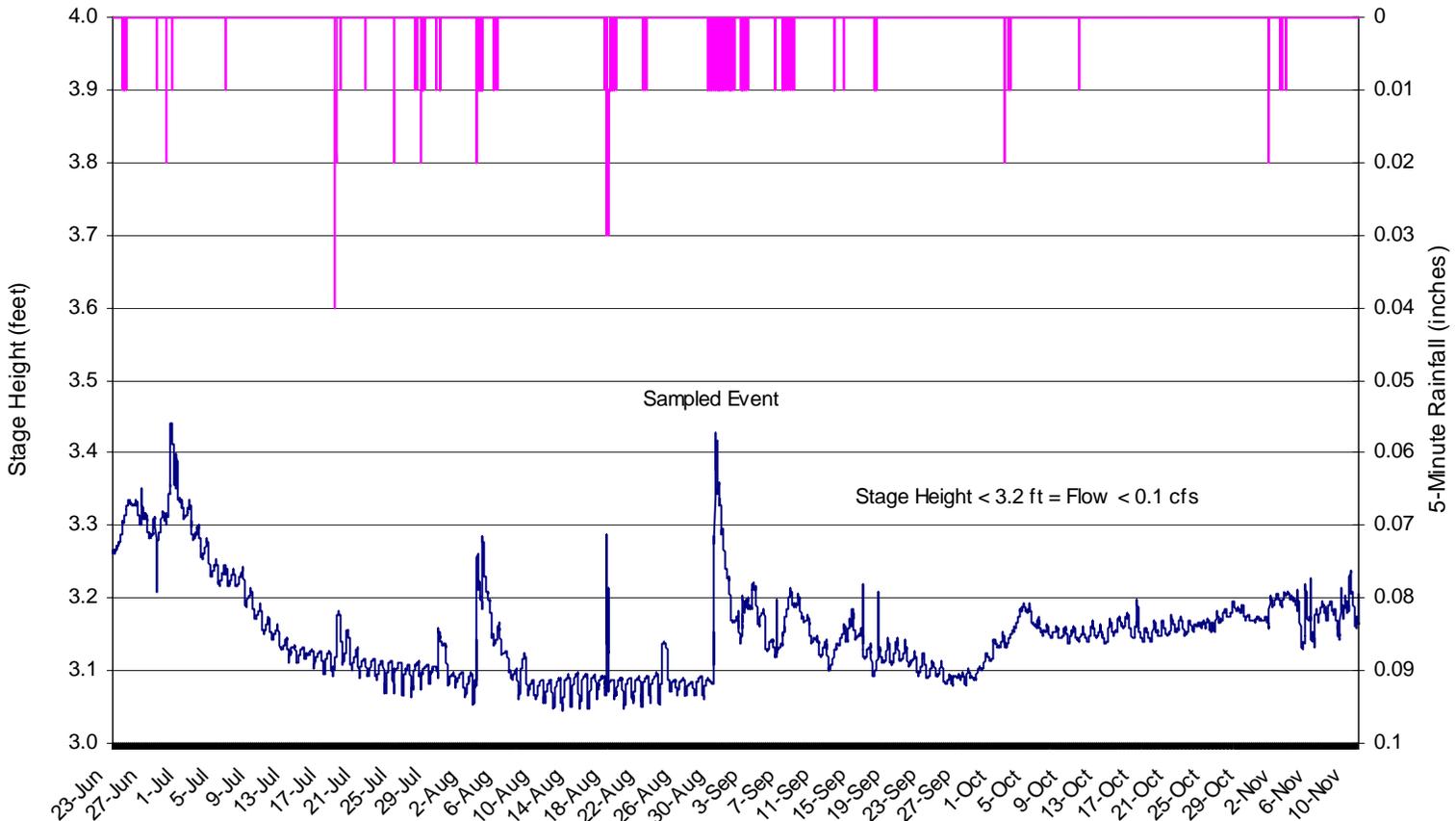


Use of Automatic-Sampling Instrumentation



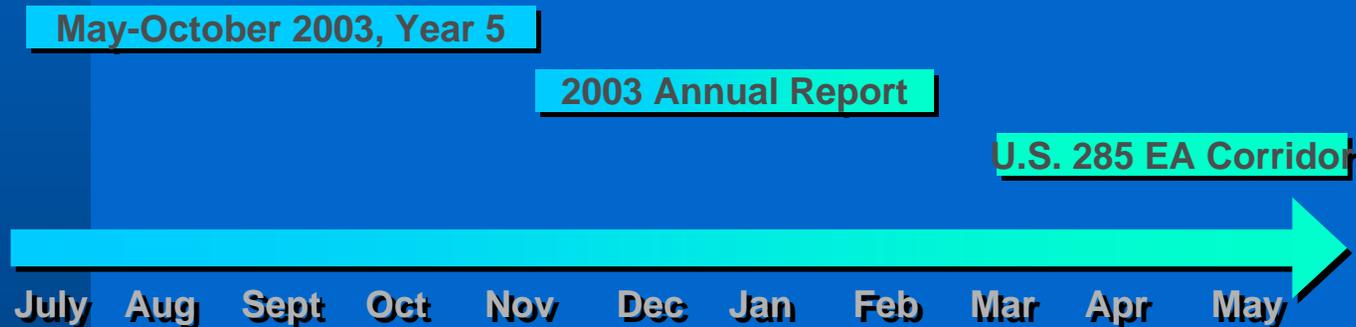
Storm-Event Sampling, 8/30/03

Figure 2a. Turkey Creek Station TC-3
June-November 2003 Stage Height and Rainfall



Reporting – The End Product!

- Interim Basic-Data Memorandum;
2003 Annual Report; Presentations



BCWA Presentation, 3/11/04

Notes: The CDOT Turkey Creek monitoring is now completed. Recommendations for 2004 monitoring along the Foxton Rd.-Bailey corridor are pending consideration.

Summary Discussion and Questions

- **Monitoring Program** – *the key cornerstone*
- **Field Observations (notes and photos)**
 - Meetings with CDOT Project Engineers
- **Documentation & Reporting**
 - Interim memos; annual reports; presentations
- **Information Transfer – Public Involvement**
 - BCWA, DRCOG, CDPH&E, other watersheds
- **Coordination with Other Studies**
 - USGS JeffCo GW; CSM; RC/DRCOG; CGS 319

Acknowledgments

- **CDOT Region 1 Environmental Staff**
- **CDOT Project Engineers**
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- **Exponent Inc. (1999-2002)**
- **Carter-Burgess (2003-2004)**
- **Clear Creek Consultants (2003-2004)**