PN-AAA-450
79481

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

DATE: 8/8/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose VO

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. C7-151
PR 12/87-5/88

Attachment

האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

INSTITUTE OF EARTH SCIENCES
PHYSICAL GEOGRAPHY

המכון למדעי כדור הארץ
גיאוגרפיה פיסית

Telephone 584469 Givat Ram, Jerusalem 91904 גבעת רם, ירושלים טלפון 584469

US-Israel AID/CDR Program C7-151

FLOODS IN EPHEMERAL STREAMS: EVALUATIONS BASED ON GEOMORPHOLOGY

PROGRESS REPORT, DECEMBER 1987 - MAY 1988

The research activity during the report period was dominated by the extraordinary floods which hit Botswana in December 1987 and February 1988. Numerous lesser flood events during the entire season, down to the end of the period reported, occurred.

The December 1987 flood on the Metsemotlhaba River, the main study site of the project, caused a large amount of damage to the equipment, described in detail in Dr. Shaw's Attachment I to this report. The plan to salvage, reinstall and reactivate the equipment, with the help of a previously unscheduled visit by Marwan Hassan of the Hebrew University, could be realized only in part, as the February floods prevented normal operations and in some cases even access. Nevertheless, some preliminary evaluations of the streamflow data in relation to the reach geomorphology and to the movement of individual tracer particles have been accomplished in the Metsemotlhaba reach as well as at the subsidiary site on the Bonwapitse River. The Bonwapitse was also subjected to a huge flood which caused extensive damage, mainly to transportation facilities.

The flow events of this first flood season of the project provided also the first field trial of the electronic streamflow measuring devices supplied to the project by ENMOS Environmental Monitoring Systems Inc., California. Three examples of flood stage records, as monitored on the Metsemotlhaba River by ENMOS equipment, are enclosed as Attachment II to this report. These charts represent a major advance in the monitoring of streamflow in sandy streams with a heavy sediment load, in which conventional float-operated mechanical recording tends to cause problems. On the other hand, certain difficulties appeared in the data registration on some of the modules. The cause of these is currently under investigation.

A field season of several weeks by a team of 3-4 researchers will take place in September-October, prior to the onset of the second flood season of the project. The main two goals of this activity will be to prepare the entire instrumental and tracer setup for the subsequent floods; to systematically undertake and complete the tracer survey at all three sites of the project; to repeat any necessary cross-sections; and to recover and monitor all scour chains.

AUG 03 1988

כל/010

The Israel counterpart projects were under routine observation during the research period. The subsidiary Nahal Yael and Nahal Hebron sites were inactive due to lack of floods -- an exception in a very wet year by Israeli standards. The Nahal Shiqma main site had four discrete minor floods. The movement and burial depth caused by these events was unexpectedly large. End-of-season recovery and resurveying operations have started.

Acknowledgments: Dr. Francis T.K. Sefe of the University of Botswana has helped us to keep the project alive under most difficult conditions, especially during periods of absence of Dr. Shaw. The staff of the Botswana Water Affairs Department and of the US AID Mission continued their support and interest. We are grateful to the University of Freiburg (Germany) and to its cooperative program with the Hebrew University of Jerusalem for financing part of Eckehard Hahn's expenses while working on this project. Messrs. Grodek, Hassan, Koorutwe, Lesole, Schoenfeld and Sharoni assisted in various aspects of the project.

20 Jul 1988

Asher P. Schick
Principal Investigator

Attachment I: Report by Co-principal investigator Dr. P. Shaw.
Attachment II: Three flood stage records, Metsemotlhaba River.
Attachment III: Abstract of paper presented to the IGU-COMTAG Workshop on Geomorphological Processes, Amsterdam-Leuven-Luxembourg, April-May 1988.

Attachment I

24th June 1988

Department of Environmental Science,
University of Botswana,
P/Bag 0022,
Gaborone,
Botswana.

US-ISRAEL CDR PROGRAMME C7-151
FLOODS IN EPHEMERAL STREAMS : EVALUATIONS BASED ON GEOMORPHOLOGY

PROGRESS REPORT 3: December 1987-May 1988

cc: Professor Schick, HUJ,
US-AID, Gaborone.

The following progress has been made on the implementation of the above project in Botswana:

The major concern has been ther unusually wet conditions experienced over the entire southern African sub-continent once the rains commenced in November 1987. Data collection reported in Progress Report 2 was disrupted by a major flood in the Metsemotlhaba River on the 22nd December, with a minimum peak discharge of 97 cumecs, the largest confirmed flow since records for the river began in 1976, and possibly as large as the major floods of 1967 and 1968. The flood removed the level gauge at the upstream site and the automatic sediment samplers at both upstream and downstream sites. The water level also rose sufficiently to flood the automatic rain gauge and put it out of action. Following the flood one sediment sampler was recovered from the river, the downstream gauge was restarted and rainfall gauge reactivated. The remaining equipment was located in the river bed but not recovered.

On my return from leave in February 1988, two weeks were spent in the field with Marwan Hassan from HUJ. The work was coincident with the wettest February in Botswana's metereological records, some 200mm of rain falling at Thamaga between 10th-17th February alone. Flow in the Metsemotlhaba prevented recovery and reinstillation of the equipment, but was very valuable for flow measurements and observation. Towards the end of the period the river level dropped sufficiently to locate two magnetic tracer, which indicated limited transport downstream, but considerable burial. The river was resurveyed at all cross-sections to permit reconstruction.

Subsequent to this field visit, intermittent heavy rain kept the Metsemotlhaba in flow until early May, whilst the high water table in the river bed has prevented recovery of the equipment. The intention is to recover the equipment as soon as the level drops in the river bed.

A visit was made to the subsidary site at Bonwapitse on 20th February, following a flood of the magnitude of the one in late November, which again washed out road and rail communications, and the Water Affairs gauging station. Useful survey information was obtained, but again conditions did not permit tracer recovery.

In some ways it is unfortunate that the first year of operation of an experiment designed to measure parameters in an average year should come up against flow conditions experienced on the 1/20-1/100 time scale. Despite these unforseen problems, however, valuable data was obtained, and more information will be collected during dry season resurvey. It is hoped that equipment recovery and reinstillation will be complete by the end of the dry season, this time taking in to account the possibility of further extreme events.

On the national scale the floods in November, and particularly February, caused considerable damage to communications and flood gauging infrastructure throughout eastern Botswana. It underlines the need for flow and sediment transport data for practical purposes.

Dr Paul Shaw

Attachment II

Sample flood stage records, 1987/88 season

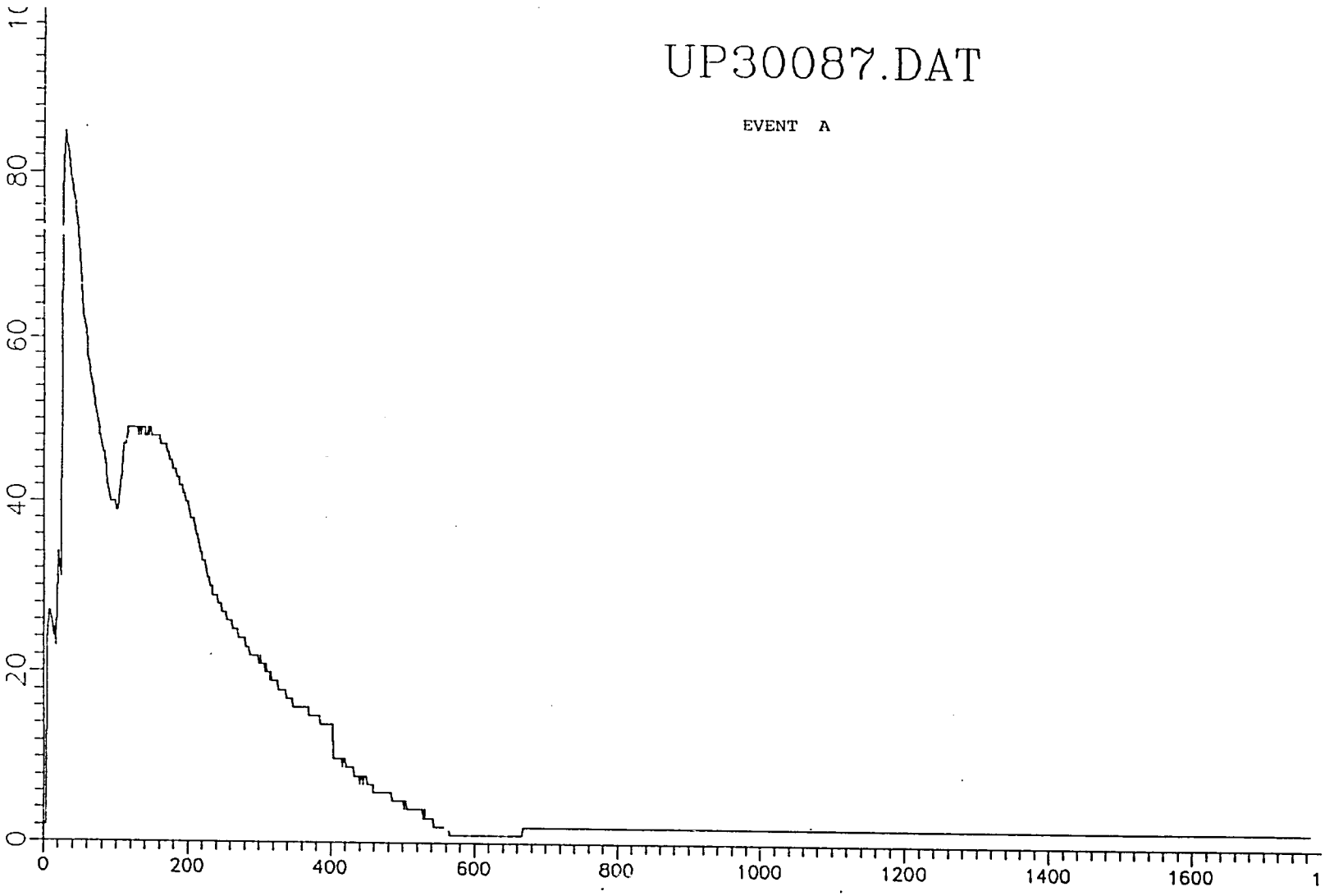
Metsemotlhaba River between Thamaqa and Moshupa

Upstream station

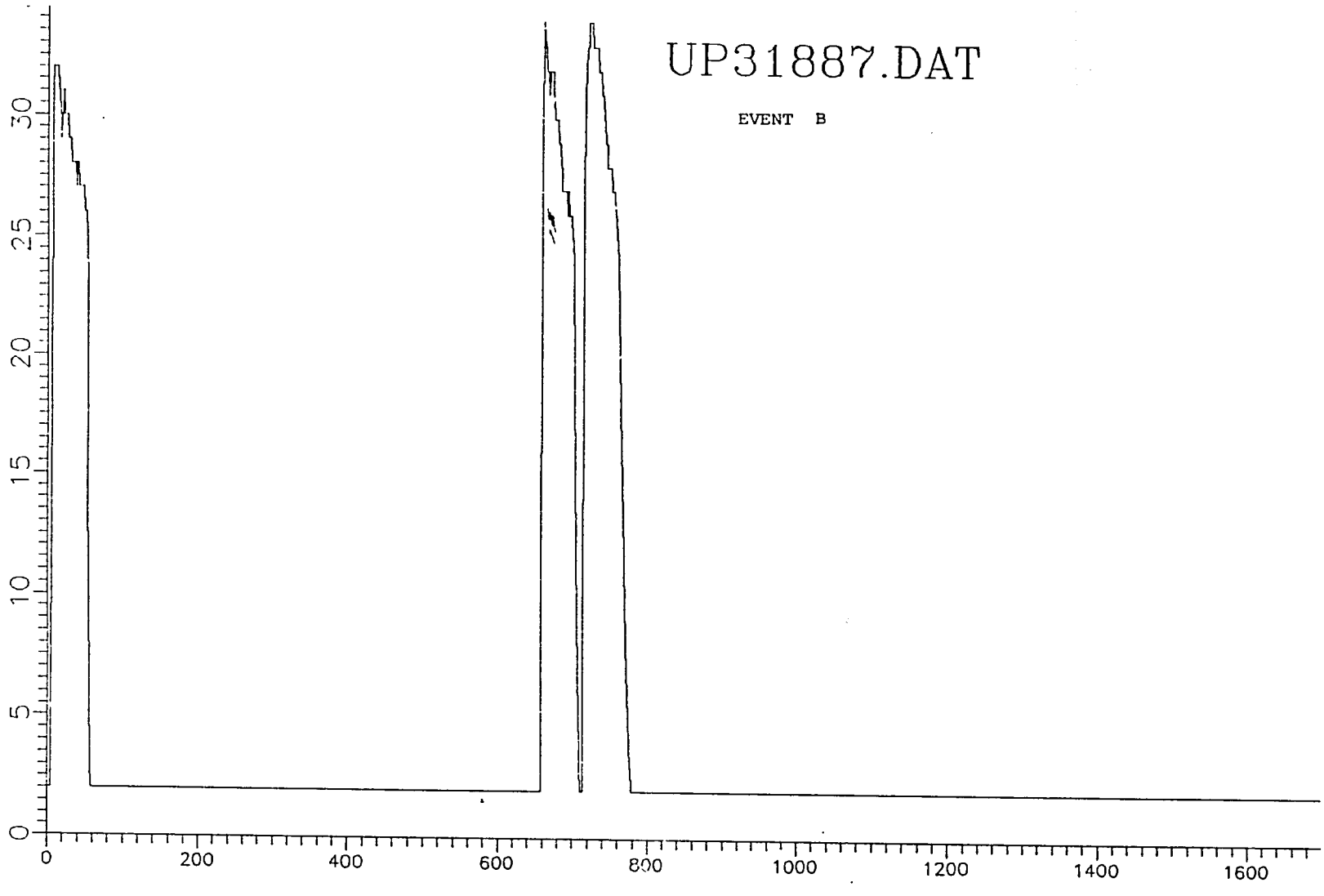
Monitored by ENMOS equipment

Horizontal scale: Time.
One unit equals two minutes.

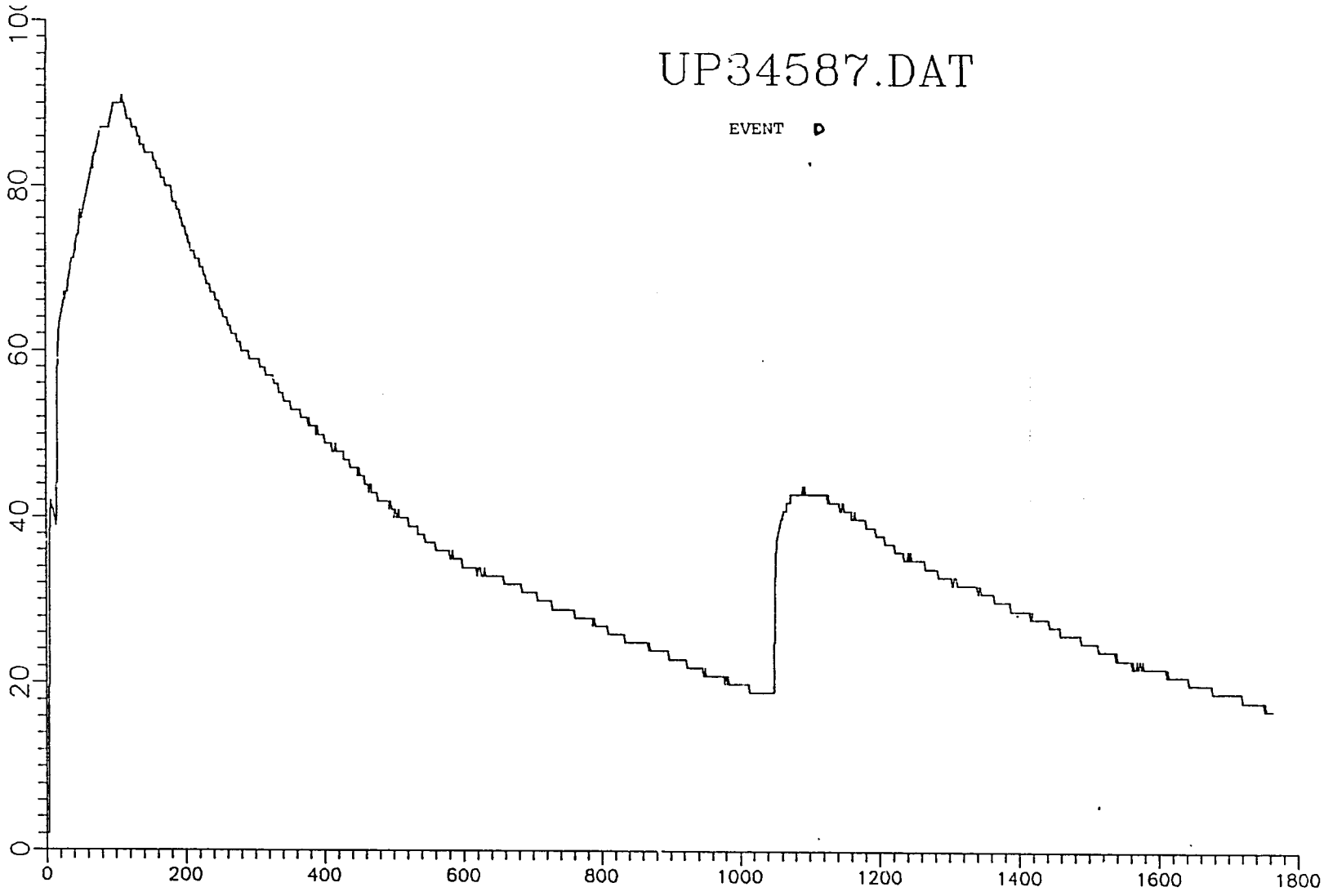
Vertical scale: Water stage.
One unit equals 1.196 (roughly 1.2) centimeters.


UP30087.DAT
EVENT A
0
20
40
60
80
0
200
400
600
800
1000
1200
1400
1600

6


UP31887.DAT
EVENT B
0
5
10
15
20
25
30
0
200
400
600
800
1000
1200
1400
1600

7


UP34587.DAT
EVENT D
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600
1800

Attachment III

FLOODS IN EPHEMERAL STREAMS - EVALUATIONS BASED ON GEOMORPHOLOGY

A P SCHICK*, P SHAW*, T GROSS*, AND M A HASSAN*
*THE HEBREW UNIVERSITY OF JERUSALEM
@UNIVERSITY OF BOTSWANA

IN SEMI-ARID OR EPHEMERAL STREAMS, LABELLED PARTICLES SEVERAL PHI-UNITS LARGER THAN THE MEDIAN BED MATERIAL, IF TRACED AFTER CONSECUTIVE EVENTS OF FLUVIAL DISPERSION, PROVIDE INFORMATION ON THE HYDROLOGIC CHARACTERISTICS OF THESE EVENTS. GEOMORPHIC OBSERVATIONS ON SIZE, SHAPE, AND MATERIAL OF BED, BANKS, AND FLOODPLAIN AND EVALUATIONS OF IN PRESENT AND OLDER FLOODMARKS, AS WELL AS HISTORICAL AND CONCURRENT INFORMATION, PROVIDE SUPPORTIVE INFORMATION. BOTH APPROACHES CAN BE COMBINED TO DEVELOP A TECHNIQUE OF ESTIMATING THE FLOW HISTORY AND FLOODING CHARACTERISTICS OF UNGAUGED SEMI-ARIDIAN RIVERS. THIS TECHNIQUE IS OF SUBSTANTIAL PRACTICAL VALUE IN THOSE DEVELOPING COUNTRIES WHICH HAVE INADEQUATE OR LOW-QUALITY GAUGING RECORDS.

A PILOT PROJECT DESIGNED TO EXPERIMENTALLY CALIBRATE THE PROCEDURE HAS BEEN SET UP ON SEVERAL EPHEMERAL SAND RIVERS IN BOTSWANA, PARALLELED BY SIMILAR SMALLER AND COARSER GRAINED STREAMS IN ISRAEL. HUNDREDS OF MAGNETIZED PEBBLES WERE EMPLACED IN EXPERIMENTAL STREAM REACHES AND THEIR THREE-DIMENSIONAL FLUVIAL DISPERSION IS BEING MONITORED. DETECTION TO DEPTHS OVE METRE AND MORE ENABLES EVALUATION OF SCOUR AND FILL, SUPPORTED AT SOME OF THE SITES BY DATA FROM SCOUR CHAINS.

THE EXPERIMENTAL LAYOUT INSTALLED AT THE MAIN SITE IN BOTSWANA, THE METSEMOTHLABA RIVER, AND SEVERAL OF THE AUXILIARY SITES IN BOTH COUNTRIES, ARE DESCRIBED AND DISCUSSED. SEVERAL PRELIMINARY RESULTS AND PROBABLE RESULT SCENARIOS ARE EVALUATED.

BEST AVAILABLE DOCUMENT