

MEMORANDUM

TO: Programs, Projects and Operations Subcommittee

FROM: Martin P. Cleveland

SUBJECT: Site Specific Probable Maximum Precipitation Study for Nebraska

DATE: August 4, 2006

Enclosed is a letter from John Miyoshi, Lower Platte North NRD (LPNNRD), and associated proposal from Applied Weather Associates to conduct a state wide probable maximum precipitation (PMP) Study for the State of Nebraska.

PMP data is used in flood control project design, such as determining the probable maximum flood (PMF) storm event for a high hazard dam. If the data is incorrect it can lead to structures being over or under designed for PMF. State of Nebraska guidelines require NRD's to use HMR 51/52 (Hydro-Meteorological Report) rainfall data unless site specific data, which meets DNR guidelines has been generated. The three problems with the HMR data are:

1. The reports were generated in 1971 and include no rainfall events that have occurred over these past 35 years.
2. Decisions within the methodology have often proven to be over-conservative when analyzed for specific regions within the great plains.
3. New science and technologies generated over these past 35 years can now be applied to these predictive models.

Mike Sotak from Olsson and Associates is working on NRD's behalf with Dr. Edward Tomlinson of Applied Weather Associates from Monument, Colorado, who has conducted Site Specific PMP Studies across the United States. Given the Nebraska geographical location within the Great Plains, Dr. Tomlinson is confident the study will lower the PMP event 20 to 25% which means a potential construction savings to NRD's.

As an example, Lower Platte North NRD believes it could reduce their Sand Creek Watershed Dam construction cost by \$1 million. Similar cost reduction might be realized with Papio Creek Watershed Structures. In addition, it may benefit existing dams, in that rehabilitation costs may be less.

Nebraska Department of Natural Resources (DNR) is willing to allow LPNNRD to apply \$58,431 of the study costs LPNNRD NRDF application along with \$40,000 in funding from dam safety funds.

A potential funding scenario proposed by Lower Platte North NRD is:

ENTITY	PERCENT	DOLLARS
NRDF	27%	\$58,431
LPNNRD	21%	\$45,849
DNR	18%	\$40,000
P-MRNRD	16%	\$35,000
LPSNRD	8%	\$17,000
CPNRD	8%	\$17,000
LENRD	3%	\$ 6,000
	TOTAL	\$219,280

Management recommends that the Subcommittee recommend to the Board that the Acting General Manager be authorized to execute an interlocal agreement for the Papio-Missouri River NRD to cost share up to \$35,000 from the Papio Reservoirs Professional Services account for a Statewide Probable Maximum Precipitation Study for the State of Nebraska to be conducted by Applied Weather Associates.



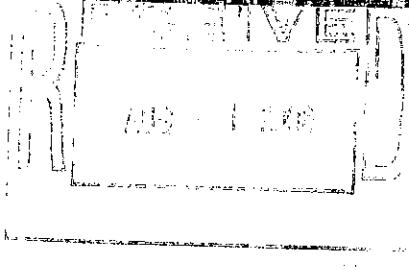
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July 31, 2006



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RE: Site Specific PMP Study for Nebraska

Dear Colleagues,

This is a follow-up to information I passed out at the last NRD Managers Meeting and to individual contacts concerning a Site Specific PMP Study for the State of Nebraska. As you know those of us in the flood control business are required to be able to pass a PMF (probable maximum flood) storm through our high hazard potential structures. State guidelines require us to use HMR 51/52 (Hydro-Meteorological Report) rainfall data unless site specific data which meets DNR guidelines has been generated. Two problems with this HMR data are:

1. The reports were generated in 1971 and include no rainfall events that have occurred over these past 35 years.
2. Decisions within the methodology have often proven to be over-conservative when analyzed for site-specific areas within the dam design industry.
3. New science and technologies generated over these past 35 years can now be applied to these predictive models.

Mike Sotak from Olsson and Associates is working on our behalf with Dr. Edward Tomlinson of Applied Weather Associates from Monument, Colorado who has conducted Site Specific PMP Studies across the United States. We have met with Dr. Tomlinson along with Pat Diederich, Brian Dunnigan and Mark Noble from DNR to review the possibility of such a study for our Sand Creek Project. Given our geographical location within the Great Plains, Dr. Tomlinson is confident the study will lower the PMP event 20 to 25% which means a potential savings to us as much as \$1

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million. Similar reductions could be shown across the entire state. **The cost for our specific need is \$97,385, but to collect and model data for the entire state would only cost an additional \$121,895 or a total cost of \$219,280.**


Looking at potential savings, our 5 NRDs and DNR would be the big winners. Papio and Central Platte have large watershed projects, Lower Elkhorn will reduce dam costs and benefits for hazard classification upgrades and rehabilitation projects can be found by Lower Platte South and Papio. DNR is willing to allow LPN to apply \$58,431 of the study costs to our NRDF application along with funding \$40,000 from dam safety funds. A potential funding scenario is:

Entity	Percent	Dollars
NRDF	27%	\$58,431
LPNNRD	21%	\$45,849
DNR	18%	\$40,000
Papio NRD	16%	\$35,000
LPSNRD	8%	\$17,000
CPNRD	8%	\$17,000
LENRD	3%	\$ 6,000
Total		\$219,280

Seven months are needed to complete the study and Dr. Tomlinson is prepared to begin immediately. If all are in agreement I will prepare an Interlocal Cooperative Act Agreement to pool the funds.

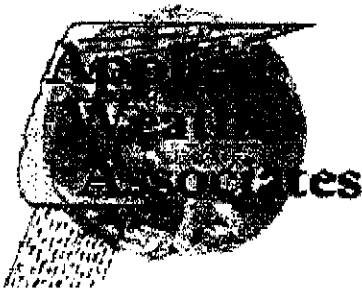
A copy of the Applied Weather Associates proposal is attached for your review. If you have general questions feel free to contact me, if you have technical questions contact Mike Sotak at 341-1116 (cell 850-6169).

Sincerely,


John R. Miyoshi
General Manager

Enclosure

pc DNR
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June 26, 2006

Proposal to Conduct a Statewide Probable Maximum Precipitation (PMP) Study for the State of Nebraska

Applied Weather Associates (AWA) proposes to conduct a site-specific probable maximum precipitation (PMP) study for the state of Nebraska. This project will provide a PMP analysis that includes comprehensive evaluations of extreme rainfall storm events including storm analyses, storm maximization, storm transpositioning, and storm aspect ratio and orientation evaluations. The results of these analyses will provide the basis for computing PMP values. All extreme rainfall storm events that have occurred over meteorologically and geographically similar regions will be studied. Comprehensive analyses of both synoptic extreme rainfall systems and smaller scale Mesoscale Convective Complexes (MCCs) extreme rainfall storms will be provided.

This PMP study will identify significant extreme rainfall storm events listed in HMR 51 that are appropriate for Nebraska. Additionally, a storm search will be completed to identify all other extreme storms including storms not identified in HMR 51 as well as extreme rainfall events that have occurred since the publication of HMR 51. Storm isohyetal and depth-area-duration analyses will be completed for extreme rainfall storm events not previously analyzed. The number of storms analyzed will depend on the results of the storm search. This proposal includes a level of effort for one complete synoptic storm analysis and one complete MCC storm analysis (two new complete storm analyses).

The rainfall amounts associated with all extreme rainfall storm events identified will be adjusted throughout the state of Nebraska using standard procedures. This task will use published storm analyses and maximization factors when available from the National Weather Service. Appropriate more recent storms identified in the EPRI Michigan/Wisconsin regional PMP study will also be included along with any new storms analyzed. A gridded analysis procedure will be used with the contribution of each transpositioned storm applied across a grid that not only covers the state of Nebraska but extends into bordering states to insure continuity across state lines.

The largest of the adjusted rainfall amounts will be used to compute PMP values for all area sizes and durations included in HMR 51. These include durations of 6, 12, 24, 48 and 72 hours and area sizes of 10, 200, 1000, 5000, 10000, and 20000 square miles. Storm types that affect

different area sizes and durations will be identified. Envelopment of the largest rainfall totals will be applied to insure spatial and temporal continuity of the final PMP values.

Storm maximization will be completed using the basic approach used in HMR 51. Following procedures used in the EPRI study, instead of using the 12-hour persisting dewpoint analyses for storm moisture quantification, average dewpoint values will be used of durations consistent with the rainfall duration. Twenty-four hour average dewpoint values will be used for synoptic storms and 6-hour average dewpoint values will be used for MCC storm types. This approach is consistent with the procedure developed in the EPRI Michigan/Wisconsin study to use dewpoint values averaged over the storm duration. The reanalysis of historic storms from the EPRI study will be used and dewpoint analyses using averages will be completed for new storms. Additionally, a climatology of 6-hour maximum average and 24-hour maximum average dewpoints will be developed for the central US to be used in the storm maximization and transpositioning procedures.

It is assumed that there will be a peer review similar to those required by other states for acceptance of site-specific PMP study results. Two meetings are proposed with the reviewer. The first would be scheduled about half way through the project and a second meeting when the draft final report is completed. These meeting could be expanded to include participation of personnel from the state dam safety office, Olsson Engineering, and other interested parties.

The following tasks will be performed in this study:

Task 1. Review previous studies and the most current HMRs for techniques applicable to the state of Nebraska. These include the EPRI Michigan/Wisconsin regional PMP study, HMR 51 and treatment of the convergent component of PMP in the newer HMRs, HMR 57 and HMR 59.

Task 2. Identify storms used in HMR 51 to establish PMP for midwestern United States and complete a storm search to identify the most significant storms that could have potentially occurred over various locations in Nebraska. Extreme rainfall-producing storm types and seasons associated with those storms will be identified. A review of characteristics associated with synoptic storm systems and Mesoscale Convective Complexes (MCCs) will be completed.

Task 3. Provide a comprehensive list of significant storm events and the characteristics of each storm. Storm data available from NWS for significant storms will be acquired and reviewed. For storms not previously analyzed, if any are identified, storm isohyetal and depth-area-duration (DAD) analyses will be completed. The number of storms analyzed will depend on the results of the storm search; two complete storm analyses, one synoptic and one MCC storm, are anticipated to be required. Maximization and transposition factors will be evaluated for storm analyses that previously had these factors completed. For new storm analyses, these factors will be computed.

Task 4. Construct a climatology of 6-hour and 24-hour maximum average dewpoints for the midwestern US. Data available on the AWA in-house data server will be used and return frequency analyses will be completed. As a minimum 25-year, 50-year and 100-year analyses will be provided for use in the storm maximization and transposition procedures.

Task 5. Perform storm maximization and transpositioning of the most extreme storms to each of the grid point locations. Consistent with the procedure developed in the EPRI Michigan/Wisconsin study, 6-hour and 24-hour maximum average dewpoint values will be used for storm maximization and transpositioning. The new climatology of maximum average dewpoint values developed in Task 4 will be used.

Storm DADs along with the maximized and transpositioned DADs will be provided. Discussions on the review of the NWS storm files will be provided. DAD curves for the largest transpositioned and maximized storms will be plotted at each grid point within the state as well as grid points just across the state lines. Standard spatial and temporal enveloping procedures will be used to produce final PMP curves at each grid point. Maps of PMP values for the Nebraska will be provided for each of the standard durations and area sizes in HMR 51.

Task 6. Quality control will be performed to insure continuity in time and space for all the final PMP values. Comparisons with HMR 51 values will be provided and explanations of the differences will be provided where possible. Since working papers for HMR 51 are not available, it may not possible to explain the source of the differences between site-specific PMP values and the generalized HMR 51 PMP values.

Task 7. Evaluate the storm orientation and aspect ratios of each of the most extreme storm events. An analysis of the storm orientations will be completed and recommendation of storm orientations constrains will be provided. Additionally, an analysis of storm aspect ratios using best fit ellipses will be provided to evaluate adjusting the storm aspect ratio depending on storm area and recommendations will be provided.

Task 8. An initial meeting is often planned for site-specific PMP studies. However, the meeting in Omaha on May 30, 2006 provided discussions that would be covered in a kick-off meeting. It is proposed that two meetings with the peer reviewer (if a peer review is provided) be held during the project and at the conclusion of the draft final report.

Task 9. A comprehensive final report will be provided. A meeting with the state dam safety officials can be provided to present and discuss the study results but is not included in this proposal.

Labor hours by task:

Task 1

Chief Meteorologist	16 hours
Staff Meteorologist	40 hours

Task 2

Chief Meteorologist	24 hours
Staff Meteorologist	70 hours

Task 3

Chief Meteorologist	40 hours
Senior Meteorologist	202 hours
Staff Meteorologist	330 hours

Task 4

Chief Meteorologist	40 hours
Senior Meteorologist	116 hours
Staff Meteorologist	320 hours

Task 5

Chief Meteorologist	60 hours
Staff Meteorologist	320 hours

Task 6

Chief Meteorologist	32 hours
Staff Meteorologist	40 hours

Task 7

Chief Meteorologist	24 hours
Staff Meteorologist	40 hours

Task 8

Chief Meteorologist	40 hours
Staff Meteorologist	60 hours

Task 9

Chief Meteorologist	60 hours
Senior Meteorologist	16 hours
Staff Meteorologist	120 hours
Clerical	80 hours

Project Management

Project Manager	96 hours
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Schedule

AWA proposed to complete the draft final report for the study in twelve (12) months. A meeting with the peer review is proposed to present the study methodology and study results after the final draft report is complete. The final report will address any comments the reviewer provides.

Costs

Labor

Chief Meteorologist and Project Manager

Dr Ed Tomlinson 432 hours @ \$165/hr \$ 71,280

Senior Scientist

Mr Tye Parzybok 334 hours @ \$ 90/hr 30,060

Staff Meteorologist

Mr Bill Kappel 1090 hours @ \$ 75/hr 81,750

Mr Bryan Rappolt 250 hours @ \$ 75/hr 18,750

Clerical

80 hours @ \$ 28/hr
2,240
\$ 204,280

Total Labor \$ 204,280

Travel

Two meetings with the peer reviewer \$ 3,000

Other Direct Costs

Data use charge \$ 700

SPAS use charge 800

Computer use charge

720 hours @ \$10/hr 7,200

Communication, copies, etc 3,500

\$12,200

Total ODCs \$ 12,200

Total Cost \$ 219,280