FINAL REPORT

THE BOULDERS BROADMOOR MASTER DEVELOPMENT DRAINAGE PLAN

Prepared for
The Boulders Broadmoor
5110 Langdale Way
Colorado Springs, Colorado 80906

January 7, 1998 (Revised: February 24, 1998) REVISED OCT. 21, 1998

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October 21, 1998

Mr. Robin Kidder
Stormwater and Engineering Review
City of Colorado Springs
101 West Costilla Street, Suite 122
Colorado Springs, CO 80901-1575

Subject: Addendum No. 1 to Boulders Broadmoor Final MDDP
Project No. 24506

Dear Rick:

As a result of review comments provided by the Colorado Geologic Survey (CGS) regarding the Master Development Drainage Plan (MDDP) for The Boulders Broadmoor development, we offer the following comments and proposed revisions related to the MDDP:

- Page 3-2, Section 3.1, Existing Drainages and Channels, 3rd paragraph--The following should be added: *"A 30-inch corrugated metal pipe (CMP) culvert and riser pipe located at the switchback on the main NORAD access road conveys runoff to Basin 500 from upstream Basin 1A. The peak 100-year discharge from this basin is relatively small, however, overflows from Basins 1B, 1C, and 1D would cause increased runoff to the culvert and riser as a result of clogging of upstream conveyance systems. Similarly, should cross culverts along the NORAD south portal access road become clogged, increased flows would be conveyed to the Boulders Broadmoor property below upstream Basins 3 and 4. Hydrologic analysis have been performed for both the existing conditions and assuming upstream conveyance facilities are clogged. The maximum flow rates determined assuming clogging of upstream conveyance systems is not recommended for design but rather to analyze the impacts to proposed on-site drainage facilities."*

- Page 5-2, Section 5.2, 1st paragraph--The following should be added in front of the last sentence: *"However, discussions with NORAD and USACOE personnel indicate that a debris flow likely occurred on NORAD property but was limited to one or both of the portal entrances and the upper parking lot areas. There is no evidence or indication that this debris flow overtopped the main NORAD access road onto the Boulders Broadmoor property. There is some indication, however, of hyperconcentrated sediment flows and significant runoff amounts which caused some channel erosion below the NORAD access road. Review of available photographs of the site, aerial photographs from 1947 and*

1966/67 and a site reconnaissance of the areas below the NORAD access road support this conclusion."

- Page 5-2, Section 5.2, 5th paragraph--The following should be revised: *The correct equation for the bulking factor is* ***BF = 1/(1-C_V)*** *and* ***"segment"*** *should be changed to* ***"sediment"***

- Page 5-2, Section 5.2, 5th paragraph--The following should be added to the last sentence: *"..., however, some hyperconcentrated sediment flows may occur."*

- Page 6-1, Last paragraph, Item 3--The following should be added: *"A minimum bulking factor of 1.2 should be utilized to account for potential hyperconcentrated sediment flows."*

- Page 6-1, Last paragraph, Item 4--The following should be added: *"Natural upstream channels should be upgraded where existing capacities are not adequate to convey the peak 100-year design flow rate bulked for potential debris where appropriate."*

- Page 6-1, Last paragraph--The following should be added as Item 5: *"To the extent possible, existing flow paths and drainages should be maintained for conveyance of flood flows. Where culverts are installed or filling of the natural drainageways is proposed, overflow provisions should be designed."*

- Page 7-1 and 7-2--The following references should be added:

  - *Lincoln-DeVore, Inc., 1987. Letter regarding Star Ranch Subdivision prepared for Berry & Boyle dated May 13, 1987.*

  - *CTL/Thompson. Inc., 1996. "Preliminary Geologic Hazards Investigation, The Boulders Broadmoor, Filing 1 and 1A, Colorado Springs, Colorado". Prepared for Berry & Boyle, Inc. Job No. CS-6155 dated February 14, 1996.*

  - *CTL/Thompson. Inc., 1996. "Preliminary Geologic Hazards Investigation, The Boulders Broadmoor, Phase II, Colorado Springs, Colorado". Prepared for Berry & Boyle, Inc. Job No. CS-6155A dated March 15, 1996.*

If you have any questions regarding this proposed addendum or if it is necessary to revise the MDDP text and issue updated reports, please contact me at 303-740-3962.

Sincerely,

Stephen W. Rogers, P.E.
Project Engineer

COLORADO REGISTERED PROFESSIONAL ENGINEER
STEPHEN W. ROGERS
28388

John W. Andrew, Ph.D.
Senior Consulting Engineer

SWR:swr

cc: Mr. Rick O'Conner (City of Colorado Springs)
Mr. Earl C. Robertson (The Boulders Broadmo
Mr. Andrew McCord (Kiowa Engineering Cor
Mr. Jon Lovekin (CTL/Thompson, Inc.)
File

The Boulders Broadmoor Master Development Drainage Plan

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City/County for master drainage plans. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Stephen W. Rogers, P.E.

COLORADO REGISTERED PROFESSIONAL ENGINEER STEPHEN W. ROGERS 28388

Developer's Statement:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

The Boulders Broadmoor

By: ______________________

Title: ______________________

Address: 5110 Langdale Way
Colorado Springs, CO 80906

City of Colorado Springs

Filed in accordance with Section 15-3-906 of the code of the City of Colorado Springs, 1980, as amended.

City Engineer ______________________ Date 2/12/99

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The Boulders Broadmoor development property is located on a series of old coalescing alluvial fans located at the eastern toe of Cheyenne Mountain west of Colorado Springs, Colorado. Residential development has occurred on the old alluvial fan surfaces below the steep canyons on the eastern slope of Cheyenne Mountain. The scenic beauty and raised elevations are desirable for residential development and, as such, The Boulders Broadmoor is planning for continued phased development. However, alluvial fans have unique hydrologic and hydraulic features. The fan surface typically displays characteristics whereby conveyance channels are neither well-defined nor stable.

Based on the presence of numerous old trees on the fan surface, it is believed that the alluvial surfaces at the base of Cheyenne Mountain are somewhat stable but, a large infrequent precipitation event and the associated runoff could cause channel instability. Engineering controls, as recommended herein, will minimize the potential for channel instability on the downstream fan surfaces.

This Master Development Drainage Plan (MDDP) has been prepared to identify drainage and conveyance issues associated with the proposed development and is required by the City of Colorado Springs for developments within any drainage basin. The purpose of the MDDP is to address major drainage planning for the proposed development before individual phases of development are undertaken. The planning is required so that drainage and hazards associated with flooding can be addressed in the design of the proposed development. This MDDP should be compatible with the Neil Ranch MDDP (KLH, 1982) and the Broadmoor Resort South MDDP (Woodward-Clyde, 1998) as updated by various drainage plans for individual developments (Watts, 1988; Watts, 1989; Kiowa Engineering, 1996) and should serve as a guide for future planning and drainage facility design. Site specific hydraulic design will be completed with the individual preliminary and final drainage reports submitted for approval.

This report presents estimates of off-site peak storm runoff discharges, estimates on-site peak runoff rates, and makes recommendations for major drainage facilities associated with the proposed development. Site specific hydrologic analysis and hydraulic design will be completed concurrently with individual preliminary and final drainage plans and reports submitted for approval.

Previous studies have been reviewed as part of the preparation of this report and have been utilized to the extent possible to maintain consistency. These studies reviewed are included in the references section of this report.

Previous analysis have identified debris flows or hyperconcentrated sediment flows to be a major design issue for drainage and conveyance facilities. This report will address the debris flow issues and make recommendations for drainage/conveyance facility design.

2.1 GENERAL LOCATION AND DESCRIPTION

The Boulders Broadmoor is located in the southwestern corner of the City of Colorado Springs in portions of Sections 12 and 13 of Township 15 South, Range 67 West of the 6th Prime Meridian. The watersheds affecting this property extend into Sections 10, 11, 14 and 15 of Township 15 South, Range 67 West of the 6th Prime Meridian. Figure 1 presents a vicinity map of the area. The proposed development is bordered on the west by Broadmoor Residential Resort Community property, to the west and south by U.S. Government property (NORAD), to the east by the JL Ranch and Neil Ranch, and to the north by Star Ranch and Broadmoor Residential Resort Community property.

All of the watershed drainages studied are tributary to Fountain Creek. Fountain Creek is a major tributary to the Arkansas River which travels south through the City of Colorado Springs.

2.2 PROPOSED DEVELOPMENT

The Boulders Broadmoor development is zoned as a Planned Urban Development (PUD) and will consist of single family residential structures. The proposed development will encompass approximately 230 acres south of Star Ranch. The proposed residential lots range from 1/4 acre to 1 acres in size.

In order to adequately identify and delineate hazards associated with extreme flood and debris flow events and determine design flow rates for conveyance facility design, an estimation of the design flood magnitude must be developed. This can be performed based on statistical flood frequency analysis of gauged stream flows or by estimation of the design rainfall event in conjunction with flood simulation via a rainfall-runoff model. Where stream gage records are limited or unavailable, regression equations may be applied to the analysis in order to supplement the lack of available data.

Review of available information indicates that there are no stream gages in or adjacent to the Boulders Broadmoor development watersheds. A hydrologic analysis for a portion of the off-site basins adjacent to the Boulders Broadmoor development was performed by FLO Engineering in 1995 (FLO Engineering, 1995) as part of the North Master Development Drainage Plan for the Broadmoor Resort Community Development (FLO Engineering, 1997). This study was reviewed and approved by the City of Colorado Springs Engineering Division, and the hydrologic analysis contained therein was reviewed as part of the preparation of this MDDP.

Additional hydrologic analysis for off-site basins were performed utilizing the HEC-1 (USACOE, 1990) computer model for both the off-site and on-site watersheds for both the existing and proposed conditions. Results of the HEC-1 computer model are included in Appendix A and further hydrologic and hydraulic computations are included in Appendix B.

3.1 DRAINAGE BASIN DESCRIPTION

The following section describes the existing hydrologic characteristics of the drainage basins related to the proposed development. The hydrologic characteristics evaluated include soils, precipitation and major drainages and channels. Exhibit A presents a general plan of the drainage basin affecting the proposed development.

Soils

The Boulders Broadmoor property soils can be described as loamy with some significant percentages of clay in some locations. The development area soils have been described in previous reports (KLH, 1982; Weiss, 1987; RCI, 1989; Muller, 1991; FLO Engineering, 1997). Rock outcrops are prevalent in the canyon drainages of Cheyenne Mountain. Along the base of Cheyenne Mountain, coalescing alluvial fans have created non-homogeneous soil groups. The majority of soils in the areas to be developed consist of the Bresser and Jarre-Tecolate Complex which are typically deep and well-drained. The clayey soils in the eastern portion of the property consist of Razor and Razor-Midway complex. Other soils found in the western vicinity of the proposed development include the Coldcreek-Tolman complex which consists of a mix of shallow to deep, well-drained soils.

Precipitation

Based on precipitation records for the Broadmoor Mountain Golf Course from 1932-1997, the average annual precipitation in the area is approximately 20 inches. The City of Colorado Springs Drainage Criteria Manual (City of Colorado Springs, 1994) suggests utilizing rainfall depths determined from National Oceanic and Atmospheric Administration (NOAA), a branch of the National Weather Service, for design purposes. Further, intense precipitation events could occur in the steep canyons of Cheyenne Mountain.

Existing Drainages and Channels

Several existing drainages and channels convey flow across the proposed development. These flow paths have shifted over time as evidenced by numerous old channel scars which exist on the fan surface and have apparent small drainage areas. This movement of a drainage channel is typical of an active alluvial fan and is an indication of potential debris flow or hyperconcentrated sediment flow.

The largest watershed, Fishers Canyon, lies upstream of Basin 300. This water shed has potential to generate debris flows. Current flow paths suggest that the majority of Fishers Canyon runoff would be conveyed to the South of Star Ranch and conveyed to the South of Star Ranch and through Boulder Broadmoor Filings 1 and 1A.

Another large off-site drainage basin exists west of the NORAD facility and has the potential to generate large runoff and potential debris flows. The NORAD facility intercepts a majority of runoff from this and adjacent watersheds. Runoff and debris are controlled by existing NORAD facilities and several conduits beneath NORAD Road.

3.2 DESIGN CRITERIA

The following discussion relates to the design criteria selected for use in determining peak runoff flow rates. Table 1 provides a summary of the hydrologic characteristics for each drainage basin evaluated. In general, the criteria outlined in the City of Colorado Springs and El Paso County Drainage Criteria Manual (City of Colorado Springs, 1994) were utilized in determining drainage basin characteristics.

Precipitation

The 100-year return period, 2-hour duration design storm of 3.10 inches was utilized for determining peak design discharges for this study. The 2-hour duration precipitation event was previously determined to produce the highest peak runoff rates within adjacent upper watersheds (FLO Engineering, 1995).

The design storm of 3.10 inches is consistent with available 24-hour precipitation records available for the Mountain Golf Course. During the last five years, the area has experienced several large extreme precipitation events. On May 29, 1995, the Mountain Golf Course precipitation gage recorded a maximum 24-hour precipitation depth of 4.30 inches. In 1994, the maximum recorded 24-hour precipitation depth at the Mountain Golf Course was 3.5 inches. Assuming a standard SCS Type II precipitation distribution, the most intense 2-hour increment of the design storm would receive on the order of 55% of the total 24-hour precipitation depth. This corresponds to an equivalent 2-hour precipitation of approximately 2.37 inches for the May 29, 1995 event. Therefore, a 100-year return period, 2-hour duration design storm of 3.10 inches appears to be reasonable.

Drainage Basin Delineation

The major basins described in previous sections were divided into numerous subbasins for hydrologic modeling purposes. In general, each subbasin represents an area of essentially similar hydrologic characteristics and was identified to determine a design flow rate at a particular point of interest including the discharge points at NORAD Road. Drainage basins were determined from available topographic mapping supplemented by a site reconnaissance of the watersheds. Available topography above elevation 7000 feet is limited in accuracy. The majority of the topography is based on the City of Colorado Springs FIMS mapping with 2-foot contours. Some of the drainage basin areas for the major off-site drainages were adopted from previous reports (FLO Engineering, 1995) after reviewing the drainages areas for consistency with available data.

Infiltration

Infiltration within the drainage basins was simulated utilizing the Natural Resources Conservation Service (formerly the Soil Conservation Service (SCS)) SCS curve number approach. The hydrologic classification of these soils is generally in Hydrologic Soil Group C to D for the upper watersheds and Hydrologic Soil Group B for the lower watersheds. The NRCS suggest a runoff curve numbers for the existing soils in the development area to be approximately 58. The weighted average curve numbers utilized in previous studies for the developed condition in the development area generally range from 72 to 78 (KLH, 1982; RCI, 1991). The effects of the development on infiltration were estimated by weighting the curve number based on the percent of development within a given basin or subbasin using an average CN of 72 for the residential areas of the development. A curve number of 72 was estimated assuming an average lot size between 0.5 and 1 acre.

Time of Concentration

The time of concentration of a watershed is defined as the time it takes for a particle of water to travel from the most remote point in the watershed to the design point. The time of concentration within the drainage basins evaluated were estimated utilizing the Kirpich method for the upper watersheds and utilizing the SCS travel time for lower watersheds. For developed conditions, the time of concentration was reduced by a minimum of 10 percent to account for decreased travel times as a result of the developed conditions. Channel routing was utilized were applicable, however, most of the drainages were determined to be too steep for any significant attenuation of flow rates created by channel storage.

3.3 RAINFALL-RUNOFF MODELING

The runoff for the 5-year and 100-year return period precipitation events were simulated using the U.S. Army Corps of Engineers HEC-1 computer program (USACOE, 1990). A rainfall-runoff model was developed for the off-site drainages at the apex of the canyons of the watersheds. The model was developed utilizing the SCS unit hydrograph methodology incorporating SCS runoff curve numbers and time of concentration parameters. The hydrologic parameters were determined for the additional drainage basins as described in the previous section.

Hydrologic Results

Peak runoff rates for the 5-year and 100-year frequency events are provided in Tables 2 and 3, respectively for both the existing and developed conditions. In general, the effects of the development on the peak runoff rates is small. However, for some of the smaller subbasins where development is planned for the majority of the watershed, peak flows may increase as much as 30 percent due to the development. Estimated developed flows are not likely to significantly impact the existing drainage facilities or private property which lie between the project area and regional detention basins. Regional detention basins have been designed to account for a portion of the increased volume created as a result of the development. More information regarding the design of the regional detention basins is provided in Section 4.3.

Peak runoff rates for developed conditions are provided on Exhibit A. Exhibit A also provides ultimate developed flow rates at specific design points as determined from previous studies. In general, the flow rates determined herein are considerably less than those previously determined. Review of previous studies indicates that this is due to 1) smaller drainage areas, 2) methodology utilized and 3) lower curve number created by less than projected development rates.

The proposed debris basin structure at the apex of Fishers Canyon has been designed to attenuate flows up to the 100-year event. As such, flow rates downstream of the structure have been greatly minimized. Further discussion of the design of this structure is included in Appendix D of the Final Report for the Broadmoor Resort Community South Master Development Drainage Plan, February 1998 (Woodward-Clyde, 1998).

A discussion of existing and proposed drainage and conveyance facilities is provided in this section.

4.1 EXISTING DRAINAGE FACILITIES

Most of the existing drainage facilities consist of culverts of various types located downstream of the development and off the project site. Existing drainage facilities are present along Star Ranch Road, Broadmoor Bluffs Drive and NORAD Road. Table 4 lists the existing drainage and conveyance facilities and their estimated capacities.

In general, most downstream existing conveyance facilities were designed to convey larger developed flows than those determined as part of this study.

4.2 PROPOSED FACILITIES

The majority of major drainage improvements are planned to be constructed in 1998. Detailed design plans for the proposed drainage improvements will be submitted with the Preliminary and Final Drainage Plans and Reports for the different filings of the proposed phased development.

The majority of proposed facilities are required to ensure that existing major drainages through the development are maintained. This can usually be performed by providing drainage easements in conjunction with minor channel improvements or by providing some sort of engineered structures to convey the flow. Because the development is located on an old alluvial fan, upstream channel stability is a concern for some of the watersheds. The proposed drainage facilities generally include flood conveyance structures within major drainage ways, local drainage improvements to convey runoff from overland flow areas to collector and main channels/culverts, and mitigation measures for hyperconcentrated sediment flows (mud and debris flows). Table 5 lists the proposed drainage and conveyance facilities for the development. The proposed facilities, discussed by basin area, are presented below.

Basin 300

A debris control structure at the apex of Fishers Canyon is being designed to eliminate the majority of sediment and debris transported to the canyon apex during the 100-year event and reduce the peak discharge downstream through the attenuation of flood waters. As a result, bulking of the water flows downstream of the structure is not expected during the 100-year event and conveyance structures will be designed to convey the peak developed 100-year discharge.

The drainage and conveyance facilities currently being constructed at the Boulders Broadmoor Filing No. 1 and 1A development are capable of passing the peak attenuated developed 100-year water flood from Fishers Canyon of approximately 362 cfs. These facilities were designed to convey runoff from a "split" of Fishers Canyon flow assuming part of the flow would be conveyed to the "north" channel and enter either Star Ranch or property north of Star Ranch including bulking of the water flow created by debris. Current conditions indicate that the majority of flow will be conveyed to the south channel.

The total 100-year design discharge bulked for sediment at the extents of Boulders Broadmoor Filing No. 1 and 1-A without the debris control/flood attenuation structure is estimated to be approximately 790 cfs, (Kiowa Engineering, 1997). The proposed structure will reduce the peak 100-year water discharge from Fishers Canyon assuming attenuation and flow conveyed to the south to an estimated peak discharge of 399 cfs.

Drainage easements will be required for the Fishers Canyon channel and will be maintained by providing either easements, channels or conveyance structures for Drainages 9A, 9B and 300B. Drainage 300 is conveyed to an existing 60-inch CMP at both Ellsworth Street and Broadmoor Bluffs Drive. These structures are estimated to have maximum capacities of approximately 366 and 390 cfs, respectively. Therefore, approximately 33 cfs would overtop the Ellsworth Street curb. Excess flow will be conveyed by Ellsworth Street curb and gutter to the sump in Broadmoor Bluffs Drive at the existing 78-inch CMP culvert crossing. No overtopping of Broadmoor Bluffs Drive is expected during the 100-year frequency design event as flood waters will spill into Basin 400B and be conveyed by the 78-inch CMP culvert crossing at Broadmoor Bluffs Drive. The existing 78-inch CMP has adequate capacity to convey peak 100-year discharges from Basin 400 as well as overflow from Basin 300 at Broadmoor Bluffs Drive.

Basin 400

Proposed improvements for Basin 400 include maintaining conveyance for Drainages 8A, 7A and 400A. Because this drainage accepts runoff from the steep canyons of Cheyenne Mountain, the potential for a debris flow exists and therefore conveyance facilities should be designed accordingly utilizing a minimum bulking factor of 2.0. The existing structures at Ellsworth Street (60" RCP) and Broadmoor Bluffs Drive (78" CMP) should be adequate to convey the peak 100-year design discharge bulked for debris flow.

Basin 500

Proposed improvements for Basin 500 include maintaining conveyance for Drainages 500A, 500C and 500B, designing street conveyance structures to pass potential debris flows and providing a larger culvert (or similar) for Ellsworth Street (if extended). Discussions with the Boulders Broadmoor indicates that the crossing will consist of a 48-inch RCP with a small detention area. This should be capable of passing the 100-year peak discharge bulked for debris flow. A berm or rechannelization may be required for Drainage 500A at approximately Elevation 6780 feet.

Drainage 500C crosses Star Ranch Road via a 24-inch pipe. Drainage 500 is ultimately conveyed to an existing 90-inch CMP riser structure with a 78-inch orifice cutout (insert) at Broadmoor Bluffs Drive. The structure was designed to store approximately 0.93 acre-feet of storage. Upon construction of regional Detention Pond No. 2, the insert is recommended (based on previous studies) to be removed thus reducing temporary storage.

Basin A

Basin A discharges through the proposed Boulders Broadmoor development south of Star Ranch. Drainage paths from the upper portions of Basin A cross proposed Buttermere Drive and

Gladstone Street. Development within Basin A will occupy approximately 60 percent of the basin area, however, the small areal extent of Basin A will likely result in limited drainage. Runoff from the steep canyons of Cheyenne Mountain is expected. The potential for debris flow is expected to be minimal as Basin A lies below the NORAD facility, which has historically intercepted the majority of debris flow off Cheyenne Mountain from past storm events.

Proposed improvements for Basin A include maintaining conveyance for Drainages 1A, 1B, 1C and 1D, which lie above NORAD Road. As Buttermere Drive and Gladstone Street transect portions of Basin A, drainage and flood control facilities will be required to convey runoff as part of the street improvements. The developed 5-year and 100-year flows from the upstream watershed were estimated to be about 71 and 310 cfs, respectively. As such, an 84-inch CMP should be adequate to convey this design flow. The downstream natural channel would require an easement from adjacent properties to maintain flow paths through Basin A. The natural channel should be adequate to convey the developed flows from the upstream watershed.

Basin B

Basin B lies below Basins A and C, however, no runoff from the adjacent upper watersheds is expected to enter Basin B. Basin B outlets to Broadmoor Bluffs Drive and the areal extent of the watershed is limited. Additionally, it is unlikely that any significant debris flow will impact Basin B as potential debris flows are likely to deposit sediment and debris on NORAD property thus limiting the amount of debris transported downstream.

Proposed improvements for Basin B include maintaining flow conveyance from this basin, and ensuring adequate conveyance for the 5-year and 100-year storm events. The 5-year and 100-year peak discharges were estimated to be 2 cfs and 12 cfs, respectively at Design Point DP8.

Basin C

Proposed improvements for Basin C include maintaining conveyance for Basin 2, designing street conveyance structures and adequately sized culvert(s) to pass flows. The basin outlet at Broadmoor Bluffs Drive, and the existing crossing for this road should adequately pass the estimated 100-year peak design discharge of 72 cfs. However, while it is anticipated that the majority of debris during past storm events has deposited on the NORAD property, there is still the potential for minor debris flows to be generated through Basin C. As such, it is recommended that peak discharges be bulked by a factor of 1.2 for on-site drainage design purposes.

Basin D

Proposed improvements for Basin D include maintaining adequate drainage through the basin, and implementation of any required flow conveyance structures required to facilitate efficient drainage. Developed peak flows for the 5-year and 100-year frequency events were estimated to be approximately 2 cfs and 6 cfs, respectively. Where Basin D lies below the majority of residential development and is situated at the easternmost portion of the development it is unlikely that significant debris flow would arise from the steep canyons in the upper watershed.

Basin E

Proposed improvements for Basin E include maintaining adequate drainage through the basin, with implementation of any required flow conveyance structures required to facilitate efficient drainage. Where Basin E lies below the majority of residential development and is situated at the easternmost portion of the development, significant debris flow arising from the steep canyons in the upper watershed is not expected. The 5-year and 100-year peak discharges were computed as 1 and 3 cfs, respectively.

Basin F

Proposed improvements for Basin F include maintaining conveyance throughout the basin and providing adequate off-basin drainage for the developed 5-year and 100-year design flows of 1 and 6 cfs, respectively. The potential for debris flow through this basin is expected to be minimal.

Basin G

Proposed improvements for Basin G include maintaining conveyance through the basin and providing adequate off-basin drainage for the developed 5-year and 100-year design flows of 3 and 17 cfs, respectively. A 24-inch CMP will be adequate to convey the 100-year design discharge. The potential for debris flow through this basin is expected to be minimal.

Basin H

Proposed improvements for Basin H include maintaining conveyance of Basins 3 and 4. As the NORAD property has intercepted the majority of debris flows from past storm events, it is unlikely that significant levels of debris will be conveyed to Basin H from the upper watersheds. However, because there is minimal potential for debris flow to pass through the basin, it is suggested that design flows for on-site runoff conveyance be bulked by a factor of 1.2. A 36-inch CMP will be adequate to convey the peak, bulked 100-year design discharge.

4.3 REGIONAL DETENTION BASINS

Regional Detention Pond No. 2 is located at Route 115 and NORAD Road and accepts flow from a portion of The Boulders Broadmoor development. The structure has been designed for a total release rate of 1280 cfs which is comparable to the historic undeveloped 100-year, 24-hour runoff event. The available storage is approximately 43 acre-feet.

A portion of runoff from the Boulders Broadmoor development is not intercepted by Regional Detention Pond No. 2. Runoff volumes will be maintained to historic levels by on-site routing to detention facilities.

The Regional Detention Ponds were designed assuming a developed Curve Number of 68 for the upstream developments, consistent with the Curve Numbers utilized in this study.

In order to minimize potential drainage problems associated with the development, adequate design of conveyance structures including addressing the effects of debris flows is required. Potential drainage problems associated with the proposed development include the following:

- flooding associated with the inability of a natural or improved channel to convey upstream runoff
- local flooding associated with the inability of a conveyance structure (i.e., culvert, bridge, etc.) to convey upstream runoff
- local flooding associated with the "clogging" of conveyance structures as a result of debris flows
- structural damage associated with high-velocity water and/or debris flows
- structural damage associated with erosion
- maintenance associated with debris and sediment deposition

The conveyance structures within the development should be designed for the 100-year debris flow (where specified) and will greatly reduce the above potential hazards. All housing structures should be located above the 100-year water and debris flooding elevation within a channel.

5.1 FLOOD HAZARDS

FEMA Flood Insurance Rate Maps (FIRM) show the study area to be classified as "Other Areas", Flood Hazard Zone X. As such, this area is determined to be outside the limits of the 500-year floodplain. Fishers Canyon was studied in detail as part of the FEMA Flood Insurance Study (FIS), however, the limits of the study appears to extend to just west of Colorado Route 115.

A statistical procedure exists for estimating the flooding hazards on alluvial fans (FEMA 1990). The evaluation is risk based and is primarily utilized for flood insurance purposes. This evaluation may be initiated by regulatory agencies for the proposed development area in the future.

In general, the natural drainages within the development area are deeply incised as a result of active alluvial fan development and are scattered across the fan surface. The flow from the major canyon watersheds have historically migrated across the alluvial fans leaving behind deeply incised channels as the flow paths have shifted over time. Current topographic conditions indicate large natural channels that appear to be "oversized" compared to the upstream watershed area.

5.2 DEBRIS FLOW HAZARDS

As recently as 1965, significant floods generated from strong, convective thunderstorms, have occurred in the vicinity of Ski Hill and Fishers Canyon. The 1965 storm generated significant runoff and conveyed mud and debris downstream of the upper watersheds north of the ski hill. There was no documentation of debris flow in Fishers Canyon or other drainages to the south from the 1965 flood event, but some minor flows may have occurred. There is a potential for future debris flow where debris flows occurred in 1965 and in adjacent basins.

Estimates of the available sediment within the eastern Cheyenne Mountain watersheds indicate that the available sediment is less than the amount that could be transported during an extreme runoff event (on the order of 10 percent). However, due to the steepness of the watersheds and low vegetative cover in the upper portions of the watersheds, a large amount of sediment and debris could become available during larger than the 25-year frequency event and it is prudent to consider that debris flows will not be sediment limited. Additionally, fire in the watersheds could reduce the vegetative cover and increase the probability of erosion and available sediment. The hazard is associated primarily with 25-year size storms and larger. Mitigation measures following fire should be implemented immediately following such an event to reduce erosion within the watershed and the amount of sediment transported downstream.

Evaluation of the watersheds above the proposed development indicate that the potential for a debris flow exists in the steep canyons of Cheyenne Mountain. However, the existing NORAD facilities located near the apex of the majority of canyons above the proposed development would intercept debris flows passing through the facility. The existing facilities will essentially act as an energy barrier limiting the velocities of flow and minimizing the sediment transport capabilities of the runoff. The NORAD parking lot will spread out concentrated flows and cause deposition of suspended/transported material. Similarly, the small culverts under NORAD Road will cause velocities to decrease and deposition to occur.

A debris control/flood attenuation structure is proposed to be constructed at the apex of Fishers Canyon. This structure will greatly reduce the debris flow hazard and peak flow rates downstream through the Boulder Broadmoor Filing 1 and 1A. The structure has been designed to store the debris flow volume transported during the 100-year frequency event.

The volume of debris transported during a flood is an average of 25-40 percent of the water volume, and the peak debris discharge is estimated at 45-55 percent of the peak water discharge (O'Brien and Julien 1997). Previous analyses have recommended, for conveyance design purposes, a minimum sediment concentration of 50 percent by volume which results in a bulking factor of 2.00 for the peak discharge and runoff volume (FLO Engineering, 1995). The bulking factor is given as BF=1 (Cl-Cv) where Cv is the average segment concentration by volume. The bulking factor accounts for increased volume taken up by sediment particles. A bulking factor of 2.00 is the recommended minimum for conveyance design of the larger drainages within the study area were the potential for a debris flow exists. A bulking factor of 1.20 is recommended for the smaller drainages below the existing NORAD facilities where the potential for debris flow is minor.

The debris flow hazard can be mitigated by avoidance, conveyance and storage. Avoidance and conveyance can be achieved by designing conveyance structures to adequately pass debris flows, maintaining the stability of debris flow channels and placing structures as high as possible above drainage channels.

This Master Development Drainage Plan provides peak design flow rates through the proposed development and indicates the need for drainage improvements for specific drainages affected by the proposed development. The off-site structures located downstream of the proposed development should be adequate to convey the peak 100-year discharge rates (bulked for sediment where appropriate) after development. Detailed design plans for proposed drainage facilities will be submitted following approval of submitted Preliminary and Final Drainage Reports and Plans.

A debris control/attenuation structure are recommended for Fishers Canyon in order to minimize debris flows and flooding during the design event. The structure will convey flows to the south of Star Ranch through the Boulders Broadmoor Filing 1 and 1A development. Flood attenuation provided by the structure will reduce peak discharges downstream. The proposed improvements for the Boulders Broadmoor Filings No. 1 and 1A development and downstream conveyance structures will be adequate to convey the 100-year design water flow from Fishers Canyon. The other drainages within the study area are much smaller in aerial extent and the probability of these drainages to generate a debris flow during a large, infrequent rainfall event is low. In addition, the existing NORAD facilities located above the proposed development will limit the amount of debris transported downstream. However, conveyance structures in drainages which originate in the steep canyons of Cheyenne Mountain (Basins 400 and 500) should be designed to carry a potential debris flood during the 100-year frequency event. In general, the structures should be designed using a peak bulking factor of 2.00 which corresponds to a peak sediment concentration of 50 percent.

In general, the peak flows determined by this MDDP are less than those previously determined. As such, downstream conveyance structures should be capable of passing the 100-year peak discharges bulked for a potential debris flood, where appropriate.

The following recommendations are made regarding the drainage facilities for the proposed development:

1. A debris control/flood attenuation structure will be constructed at the apex of Fishers Canyon. This structure will reduce peak discharges downstream and minimize flooding/debris flow hazards through the Boulders Broadmoor Filing 1 and 1A.
2. Conveyance structures within Basins 400 and 500 will be designed to convey potential debris flows by utilizing a minimum bulking factor of 2.0.
3. The existing NORAD facility will intercept the majority of runoff debris flows generated in the upper watersheds of the Basins 1, 2, 3 and 4. As such, the potential for debris flows through the development is expected to be minimal.
4. Drainage facilities should be designed to pass the peak 100-year discharges as presented in Table 5.

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TABLE 1
SUMMARY OF HYDROLOGIC PARAMETERS

Basin ID	Area (mi²)	Curve Number Existing	Curve Number Developed	Lag Time Existing (hours)	Lag Time Developed (hours)	% Impervious
34	0.023	74	74	0.125	0.125	7
5	0.042	74	74	0.131	0.131	7
6	0.022	74	74	0.131	0.131	7
7	0.014	74	74	0.107	0.107	7
8-1	0.056	74	74	0.113	0.113	7
8-2	0.016	74	74	0.086	0.086	7
8-3	0.021	74	74	0.202	0.202	7
9	0.085	74	74	0.125	0.125	4
1011-1	0.035	74	74	0.160	0.160	7
1011-2	0.037	74	74	0.160	0.160	7
12-1	0.089	76	76	0.126	0.126	6
12-2	0.028	76	76	0.113	0.113	6
12-3	0.027	76	76	0.145	0.145	6
12-4	0.038	75	75	0.110	0.110	6
12-5	0.081	76	76	0.154	0.154	10
12-6	0.061	76	76	0.129	0.129	10
12-7	0.016	75	75	0.134	0.134	5
12-8	0.023	75	75	0.077	0.077	5
12-9	0.021	75	75	0.112	0.112	4
12-10	0.069	75	75	0.170	0.170	5
12-11	0.041	74	74	0.073	0.073	10
1A	0.023	78	78	0.15	0.150	5
1B	0.231	78	78	0.27	0.270	5
1C	0.037	78	78	0.22	0.220	5
1D	0.05	78	78	0.04	0.040	5
2	0.043	78	78	0.19	0.190	5
2X	0.005	78	78	0.13	0.130	5
3	0.069	78	78	0.26	0.260	5
4	0.096	78	78	0.21	0.210	5
A	0.091	58	72	0.25	0.230	5
B	0.018	58	72	0.15	0.140	5
C	0.088	58	72	0.19	0.170	5
D	0.023	58	72	0.160	0.160	5
E	0.01	58	72	0.14	0.140	5
F	0.009	58	72	0.13	0.130	5
G	0.034	58	72	0.19	0.190	5
H	0.03	58	72	0.19	0.170	5
300A	0.049	58	65	0.313	0.162	4
300B	0.026	58	68	0.247	0.126	4
300C	0.06	58	72	0.288	0.150	4
400A	0.02	58	72	0.406	0.210	4
400B	0.01	58	72	0.406	0.210	4
500A	0.036	58	72	0.313	0.162	4
500B	0.009	58	72	0.208	0.108	4
500C	0.015	58	72	0.208	0.108	4

TABLE 2
5-YEAR PEAK DISCHARGE RESULTS

	Developed		Existing	
Basin ID	$Q_{5YR\text{-}2HR}$ (cfs)	5 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)	$Q_{5YR\text{-}2HR}$ (cfs)	5 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)
Basin 500				
34	5	217	5	217
500C	2	133	1	67
5	9	214	9	214
6	5	227	5	227
500A	5	139	2	56
DP500	23	167	19	138
500B	1	11	1	11
DP501	24	163	20	136
Basin 400				
7	3	250	3	250
8-1	12	214	12	214
8-2	4	250	4	250
8-3	4	190	4	190
DP7A	22	210	22	210
400A	2	100	1	50
DP401	24	192	22	176
400B	1	33	<1	<100
DP402	24	178	22	163
Basin 300				
12-1	22	247	22	247
12-2	7	250	7	250
12-3	6	222	6	222
12-4	9	237	9	237
12-5	23	284	23	284
12-6	18	295	18	295
12-7	3	188	3	188
12-8	5	217	5	217
12-9	4	191	4	191
12-10	13	188	13	188
Fishers Canyon	57	126	--	--
12-11	11	275	11	275
DP6	61	124	109	221
1011-1	7	200	7	200
1011-2	7	189	7	189
DP8	70	124	121	214
300A	3	61	3	61
9	15	176	15	176
300B	2	77	2	77
DP301	84	109	136	177
300C	8	133	3	50
DP302	90	108	137	165
Basin A				
1A	6	261	6	261

TABLE 2
5-YEAR PEAK DISCHARGE RESULTS

	Developed		Existing	
Basin ID	$Q_{5YR-2HR}$ (cfs)	5 Year$_{Unit\ Peak\ Runoff}$ (cfs/mi^2)	$Q_{5YR-2HR}$ (cfs)	5 Year$_{Unit\ Peak\ Runoff}$ (cfs/mi^2)
1B	52	225	52	225
1C	9	243	9	243
DP 1BC	61	--	61	--
1D	18	360	18	360
DP 1ABCD	68	--	68	--
A	11	121	7	77
DP 1	70	--	63	--
Basin C				
2	11	256	11	256
2X	1	200	1	200
C	12	136	8	91
DP 2	18	--	11	--
Basin H				
3	16	232	16	232
4	24	250	24	250
H	4	133	3	100
DP 3	28	--	25	--
Basin B				
B	3	167	2	111
Basin D				
D	3	130	2	87
Basin E				
E	1	100	1	100
Basin F				
F	18	2000	1	111
Basin G				
G	4	118	3	88

TABLE 3
100-YEAR PEAK DISCHARGE RESULTS

Basin ID	Developed $Q_{100YR\text{-}2HR}$ (cfs)	Developed $V100_{YR\text{-}2HR}$ (ac-ft)	Developed 100 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)	Existing $Q_{100YR\text{-}2HR}$ (cfs)	Existing $V100_{YR\text{-}2HR}$ (ac-ft)	Existing 100 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)
Basin 500						
34	26	1	1130	26	1	1130
500C	15	1	1000	4	0	267
5	47	2	1119	47	2	1119
6	25	1	1136	25	1	1136
500A	31	2	861	8	1	222
DP500	133	7	964	98	6	710
500B	9	1	1000	2	0	222
DP501	141	8	959	100	6	680
Basin 400						
7	17	1	1417	17	1	1417
8-1	66	3	1179	66	3	1179
8-2	20	1	1250	20	1	1250
8-3	20	2	952	20	2	952
DP7A	117	7	1114	117	7	1114
400A	16	1	800	4	0	200
DP401	128	8	1024	118	8	944
400B	8	1	800	2	0	200
DP402	134	9	993	119	8	881
Basin 300						
12-1	112	5	1258	112	5	1258
12-2	37	2	1321	37	2	1321
12-3	32	2	1185	32	2	1185
12-4	47	3	1237	47	3	1237
12-5	102	5	1259	102	5	1259
12-6	82	3	1344	82	3	1344
12-7	18	1	1125	18	1	1125
12-8	31	1	1348	31	1	1348
12-9	25	2	1196	25	2	1196
12-10	72	4	1043	72	4	1043
Fishers Canyon	222	28	490	--	--	--
12-11	57	3	1390	57	3	1390
DP6	240	23	486	564	31	1142
1011-1	37	2	1057	37	2	1057
1011-2	39	3	1054	39	3	1054
DP8	274	28	484	630	36	113
300A	25	2	510	11	1	224
9	91	5	1071	91	2	1071
300B	18	1	692	6	1	231
DP301	362	36	471	718	42	935
300C	53	3	883	14	1	233
DP302	399	39	481	721	43	871
Basin A						
1A	30	2	1304	30	2	1304
1B	234	16	1013	234	16	1013
1C	41	3	1108	41	3	1108
DP 1BC	273	19	--	273	19	--
1D	93	3	1860	93	3	1860

TABLE 3
100-YEAR PEAK DISCHARGE RESULTS

	Developed			Existing		
Basin ID	$Q_{100YR-2HR}$ (cfs)	$V100_{YR-2HR}$ (ac-ft)	100 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)	$Q_{100YR-2HR}$ (cfs)	$V100_{YR-2HR}$ (ac-ft)	100 $Year_{Unit\ Peak\ Runoff}$ (cfs/mi^2)
DP 1ABCD	302	22	--	302	22	--
A	69	5	758	24	2	264
DP 1	335	27	--	299	24	--
Basin C						
2	51	3	1186	51	3	1186
2X	7	<1	1400	7	<1	1400
C	78	5	886	25	2	284
DP 2	99	8	--	52	5	--
Basin H						
3	70	5	1014	70	5	1014
4	109	7	1135	109	7	1135
H	26	2	867	8	1	267
DP 3	135	13	--	124	12	--
Basin B						
B	18	1	1000	6	<1	333
Basin D						
D	18	1	783	6	<1	261
Basin E						
E	9	1	900	3	<1	300
Basin F						
F	123	7	13667	3	<1	333
Basin G						
G	25	2	735	8	1	235

TABLE 4
EXISTING DRAINAGE AND CONVEYANCE FACILITIES

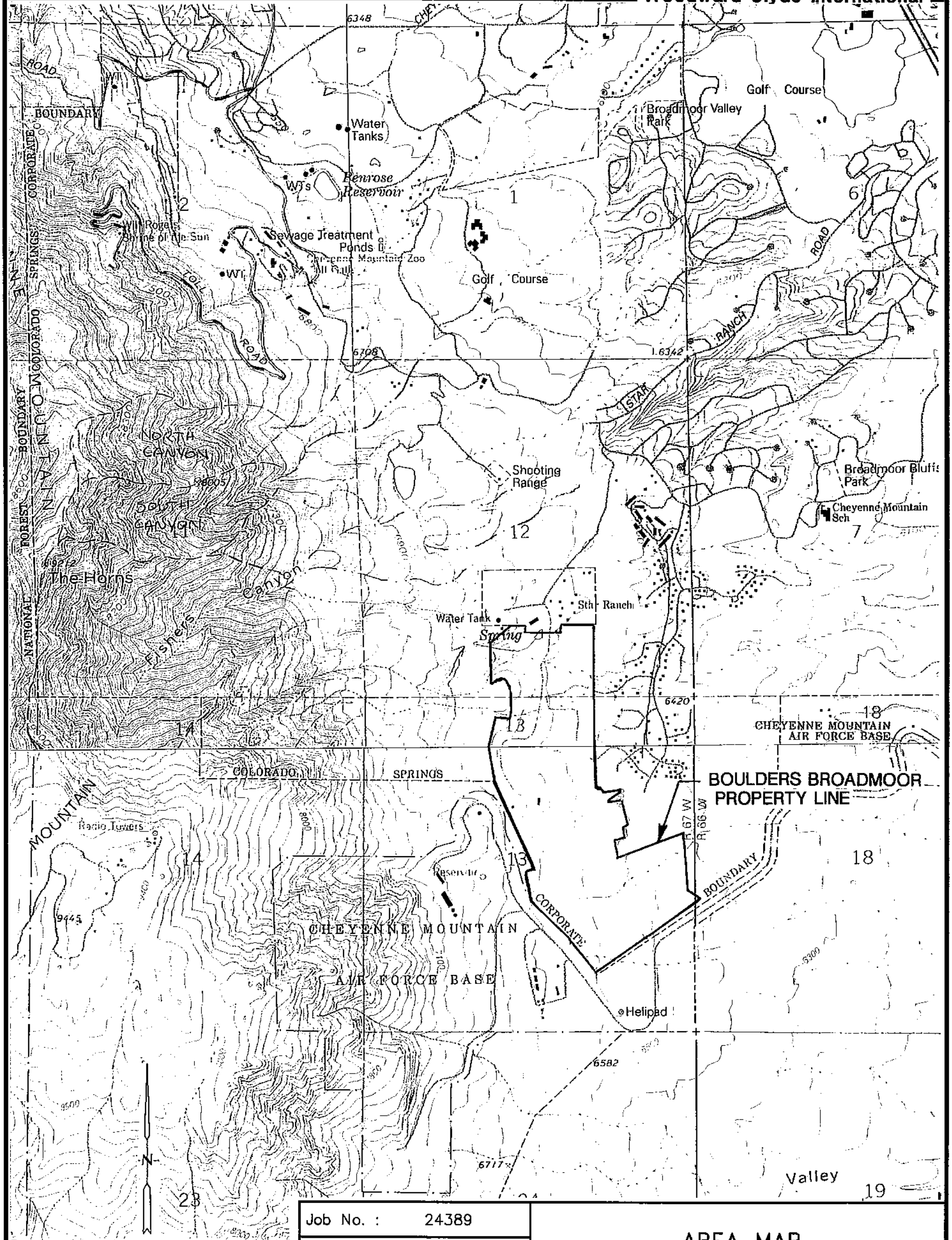
Location	Type & Size	Approximate Capacity (cfs)	100-Year Developed Capacity (cfs)
Basin 1			
DP1ABCD	66"-CMP	380	310
Basin 2			
DPB2	30"-CMP	93	47
DPB2X	24"-CMP	45	6
Basin 3			
DP3	42"-CMP	69	66
Basin 4			
DP4	42"-CMP	119	101
Basin A			
DP1	84"-CMP	477	330
Basin H			
DP3	36"-CMP	124	17
Basin 300			
Jarman Street	2x66"-RCP	750	362
Stonebeck Lane	66"-RCP	450	362
Ellsworth Street	60"-RCP	366	399
Broadmoor Bluffs Drive	60"-CMP	390	399
Basin 400			
Broadmoor Bluffs Drive	78"-CMP	646	134
Star Ranch Road	18"-CMP	13	134
Ellsworth Street	60"-CMP	310	134
Basin 500			
Star Ranch Road	18"-CMP	14	72
Star Ranch Road	24"-HDPE	31	41
Star Ranch Road	18"-CMP	14	9
Ellsworth Street	48"-CMP	200	133

TABLE 5
PROPOSED DRAINAGE AND CONVEYANCE FACILITIES

Location	Type & Size	5-Year Developed Capacity (cfs)	100-Year Developed Capacity (cfs)	Minimum Capacity (cfs)	Debris Flow Bulking Factor
Basin B					
DPB	Culvert Crossing	2	12	14	1.2
Basin C					
DPC	Culvert Crossing	12	72	86	1.2
Basin D					
DPD	Culvert Crossing	2	6	7	1.2
Basin E					
DPE	Culvert Crossing	1	3	4	1.2
Basin F					
DPF	Culvert Crossing	1	6	7	1.2
Basin G					
DPG	24"-CMP[1]	3	17	20	1.2
Basin 300					
Berm Adj. to 300B	Earthfill/riprap channel	17	91	180	2
Fishers Canyon Dam	Debris Basin	110	564	1120	2
--	Drainage Easement	121	370	370	1
--	Drainage Easement	17	109	218	2
Basin 400					
--	Drainage Easement	20	128	260	2
Basin 500					
Ellsworth Street Expansion	Culvert Crossing	16	133	270	2
Berm Adj. to 500A	Earthfill/riprap channel	12	72	144	2
--	Drainage Easement	12	72	144	2
--	Drainage Easement	4	26	52	2

(1) Installation of 24"-CMP at proposed NORAD entry facility

Woodward-Clyde International



Job No. :	24389
Prepared by :	S.W.R.
Date :	1/6/98

AREA MAP

4389TB

FIG. 1

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1***************************************                                                     ***************************************
 *                                     *                                                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *           SEPTEMBER 1990            *                                                     *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.0              *                                                     *         609 SECOND STREET           *
 *                                     *                                                     *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE  02/24/1998  TIME  09:38:21 *                                                   *          (916) 756-1104             *
 *                                     *                                                     *                                     *
***************************************                                                     ***************************************




                                         X     X  XXXXXXX   XXXXX          X
                                         X     X  X        X     X        XX
                                         X     X  X        X               X
                                         XXXXXXX  XXXX     X       XXXXX   X
                                         X     X  X        X               X
                                         X     X  X        X     X         X
                                         X     X  XXXXXXX   XXXXX         XXX




           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                   HEC-1 INPUT                                                   PAGE  1

          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1            ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
            2            ID        5-YR,2-HR       EXISTING           PART 1
            3            ID        FULL BASIN RUNOFF STUDY          5BX1.DAT
                         *DIAGRAM
            4            IT       1 01DEC97    1200    1500
            5            IN       5
            6            IO       5       0

            7            KK     B34
            8            KM        RUNOFF FROM SDA        34
            9            BA    .023
           10            PB     1.6
           11            PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
           12            PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
           13            PI     .01     .01     .01     .01
           14            LS       0      74       7
           15            UD    .125

           16            KK     J-J
           17            KM        ROUTE FLOW FROM B3 THRU 500C
           18            RS       1    STOR       0
           19            RC    0.12     .08    0.12    1500     .21
           20            RX       0       5      10      20      28      38      43      48
           21            RY      15    12.5      10       0       0      10    12.5      15

           22            KK    500C
           23            KM         RUNOFF FROM 500C
           24            BA    .015
           25            LS       0      58       4
           26            UD    .208

           27            KK   DP345
           28            KM        COMBINE SDAs 34 & 500C
           29            HC       2

           30            KK      B5
           31            KM        RUNOFF FROM SDA 5
           32            BA    .042
           33            LS       0      74       7
           34            UD    .131
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 35          KK      B6
 36          KM         RUNOFF FROM SDA 6
 37          BA     .022
 38          LS        0       74        7
 39          UD     .131

 40          KK    DP56
 41          KM         COMBINE FLOWS FROM SDAs 5&6
 42          HC        2
1                                        HEC-1 INPUT                                        PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 43          KK     K-K
 44          KM         ROUTE FLOW FROM DP 56 THRU 500A
 45          RS        1     STOR        0
 46          RC     0.12      .08     0.12     2100      .22
 47          RX        0        5       10       20       28       38       43       48
 48          RY       15     12.5       10        0        0       10     12.5       15

 49          KK    500A
 50          KM         RUNOFF FROM SDA 500A
 51          BA     .036
 52          LS        0       58        4
 53          UD     .313

 54          KK   DP500
 55          KM         COMBINE FLOWS FROM CP56&500A
 56          HC        3

 57          KK    500B
 58          KM         RUNOFF FROM SDA 500B
 59          BA     .009
 60          LS        0       58        4
 61          UD     .208

 62          KK   DP501
 63          KM         COMBINE FLOWS FROM CP5A&500B
 64          HC        2

 65          KK      B7
 66          KM         RUNOFF FROM SDA 7
 67          BA     .014
 68          LS        0       74        7
 69          UD     .107

 70          KK    B8-1
 71          KM         RUNOFF FROM SDA 8-1
 72          BA     .056
 73          LS        0       74        7
 74          UD     .113

 75          KK    B8-2
 76          KM         RUNOFF FROM SDA 8-2
 77          BA     .016
 78          LS        0       74        7
 79          UD     .086

 80          KK     DP7
 81          KM         COMBINE FLOWS FROM SDAs 8-1, 8-2
 82          HC        2
1                                        HEC-1 INPUT                                        PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 83          KK    B8-3
 84          KM         RUNOFF FROM SDA 8-3
 85          BA     .021
 86          LS        0       74        7
 87          UD     .202

 88          KK    DP7A
 89          KM         COMBINE FLOW FROM CP7 & SDA 8-3 &B7
 90          HC        3

 91          KK    400A
 92          KM         RUNOFF FROM SDA     400A
 93          BA      .02
```

```
 94     LS       0      58       4
 95     UD    .506

 96     KK   DP401
 97     KM        COMBINE FLOWS FROM DP7A & SDA 400A
 98     HC       2

 99     KK    400B
100     KM        RUNOFF FROM SDA     400B
101     BA     .01
102     LS       0      58       4
103     UD    .406

104     KK   DP402
105     KM        COMBINE FLOWS FROM DP402& SDA 400B
106     HC       2

107     KK     B1A
108     KM        RUNOFF FROM BASIN 1A
109     BA   0.023
110     LS       0      78       5
111     UD    0.15

112     KK     B1B
113     KM        RUNOFF FROM BASIN 1B
114     BA   0.231
115     LS       0      78       5
116     UD    0.27

117     KK     B1C
118     KM        RUNOFF FROM BASIN 1C
119     BA   0.037
120     LS       0      78       5
121     UD    0.22

122     KK   DP1BC
123     KM        COMBINE FLOWS FROM BASIN 1B & 1C
124     HC       2
```



```
LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


125     KK     A-A
126     KM        ROUTE FLOW FROM DP1BC THRU BASIN 1D
127     RS       1    STOR       0
128     RC    0.12    0.08    0.12    1600    0.21
129     RX       0       5      10      20      28      38      43      48
130     RY      15    12.5      10       0       0      10    12.5      15

131     KK     B1D
132     KM        RUNOFF FROM BASIN 1D
133     BA   0.050
134     LS       0      78       5
135     UD    0.04

136     KK DP1ABCD
137     KM        COMBINE FLOWS FROM BASINS 1A THRU 1D
138     HC       2

139     KK     C-C
140     KM        ROUTE FLOW FROM BASINS 1A-1D THRU BASIN A
141     RS       1    STOR       0
142     RC    0.12    0.08    0.12    4000     .08
143     RX       0       5      10      20      28      38      43      48
144     RY      15    12.5      10       0       0      10    12.5      15

145     KK      BA
146     KM        RUNOFF FROM BASIN A
147     BA    0.09
148     LS       0      58       5
149     UD    0.25

150     KK     DP1
151     KM        COMBINE FLOWS FROM BASINS 1A-1D & BASIN A
152     HC       2

153     KK      B2
154     KM        RUNOFF FROM BASIN 2
155     BA   0.043
```

```
           LS       0       78        5
           UD    0.19

           KK      D-D
           KM         ROUTE FLOW FROM BASIN 2 THRU BASIN C
           RS       1     STOR        0
           RC    0.12     0.08     0.12     6400     0.07
           RX       0        5       10       20       28       38       43       48
           RY      15     12.5       10        0        0       10     12.5       15

           KK      B2X
           KM         RUNOFF FROM BASIN 2X
           BA    .005
           LS       0       78        5
           UD    0.13
1                                  HEC-1 INPUT                                                  PAGE  5

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


           KK      X-X
           KM         ROUTE FLOW FROM BASIN 2XTHRU BASIN C
           RS       1     STOR        0
           RC    0.12     0.08     0.12      490     0.49
           RX       0        5       10       20       28       38       43       48
           RY      15     12.5       10        0        0       10     12.5       15

           KK       BC
           KM         RUNOFF FROM BASIN C
           BA    0.09
           LS       0       58        5
           UD    0.19

           KK      DP2
           KM         COMBINE FLOWS FROM BASINS 2,2X & C
           HC       3

           KK       B3
           KM         RUNOFF FROM BASIN 3
           BA  0.0687
           LS       0       78        5
           UD    0.26

           KK      E-E
           KM         ROUTE FLOW FROM BASIN 3 THRU BASIN H
           RS       1     STOR        0
           RC    0.12     0.08     0.12     7200     0.03
           RX       0        5       10       20       28       38       43       48
           RY      15     12.5       10        0        0       10     12.5       15

           KK       B4
           KM         RUNOFF FROM BASIN 4
           BA   0.096
           LS       0       78        5
           UD    0.21

           KK      F-F
           KM         ROUTE FLOW FROM BASIN 4 THRU BASIN H
           RS       1     STOR        0
           RC    0.12     0.08     0.12     2800     0.05
           RX       0        5       10       20       28       38       43       48
           RY      15     12.5       10        0        0       10     12.5       15

           KK       BH
           KM         RUNOFF FROM BASIN H
           BA    0.03
           LS       0       58        5
           UD    0.19
1                                  HEC-1 INPUT                                                  PAGE  6

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


           KK      DP3
           KM         COMBINE FLOWS FROM BASINS 3, 4 & H
           HC       3

           KK       BB
           KM         RUNOFF FROM BASIN B
           BA    0.02
```

```
         216          LS       0      58       5
         217          UD    0.15

         218          KK       BD
         219          KM         RUNOFF FROM BASIN D
         220          BA    0.02
         221          LS       0      58       5
         222          UD    0.16
         223          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7         B34
                V
                V
   16         J-J
                .
                .
   22           .         500C
                .            .
                .            .
   27       DP345............
                .
                .
   30           .           B5
                .            .
                .            .
   35           .            .          B6
                .            .           .
                .            .           .
   40           .         DP56............
                .            V
                .            V
   43           .          K-K
                .            .
                .            .
   49           .            .        500A
                .            .           .
                .            .           .
   54       DP500.........................
                .
                .
   57           .         500B
                .            .
                .            .
   62       DP501............
                .
                .
   65           .           B7
                .            .
                .            .
   70           .            .       B8-1
                .            .           .
                .            .           .
   75           .            .           .       B8-2
                .            .           .           .
                .            .           .           .
   80           .            .         DP7............
                .            .           .
                .            .           .
   83           .            .           .       B8-3
                .            .           .           .
                .            .           .           .
   88           .         DP7A........................
                .            .
                .            .
   91           .            .        400A
                .            .           .
                .            .           .
   96           .        DP401............
                .            .
                .            .
   99           .            .        400B
                .            .           .
                .            .           .
  104           .        DP402............
```

```
               .           .
               .           .
  107          .           .         B1A
               .           .           .
               .           .           .
  112          .           .           .         B1B
               .           .           .           .
               .           .           .           .
  117          .           .           .           .         B1C
               .           .           .           .           .
               .           .           .           .           .
  122          .           .           .       DP1BC............
               .           .           .           V
               .           .           .           V
  125          .           .           .         A-A
               .           .           .           .
               .           .           .           .
  131          .           .           .           .         B1D
               .           .           .           .           .
               .           .           .           .           .
  136          .           .           .      DP1ABC............
               .           .           .           V
               .           .           .           V
  139          .           .           .         C-C
               .           .           .           .
               .           .           .           .
  145          .           .           .           .          BA
               .           .           .           .           .
               .           .           .           .           .
  150          .           .           .         DP1............
               .           .           .           .
               .           .           .           .
  153          .           .           .           .          B2
               .           .           .           .           V
               .           .           .           .           V
  158          .           .           .           .         D-D
               .           .           .           .           .
               .           .           .           .           .
  164          .           .           .           .           .         B2X
               .           .           .           .           .           V
               .           .           .           .           .           V
  169          .           .           .           .           .         X-X
               .           .           .           .           .           .
               .           .           .           .           .           .
  175          .           .           .           .           .           .          BC
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
  180          .           .           .           .         DP2........................
               .           .           .           .           .
               .           .           .           .           .
  183          .           .           .           .           .          B3
               .           .           .           .           .           V
               .           .           .           .           .           V
  188          .           .           .           .           .         E-E
               .           .           .           .           .           .
               .           .           .           .           .           .
  194          .           .           .           .           .           .          B4
               .           .           .           .           .           .           V
               .           .           .           .           .           .           V
  199          .           .           .           .           .           .         F-F
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
  205          .           .           .           .           .           .           .          BH
               .           .           .           .           .           .           .           .
               .           .           .           .           .           .           .           .
  210          .           .           .           .           .         DP3........................
               .           .           .           .           .           .
               .           .           .           .           .           .
  213          .           .           .           .           .           .          BB
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
  218          .           .           .           .           .           .           .          BD

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                           ***************************************
*                                       *                                           *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                           *    U.S. ARMY CORPS OF ENGINEERS     *
*           SEPTEMBER 1990              *                                           *    HYDROLOGIC ENGINEERING CENTER    *
*             VERSION 4.0               *                                           *          609 SECOND STREET          *
*                                       *                                           *       DAVIS, CALIFORNIA 95616       *
```

BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
5-YR,2-HR EXISTING PART 1
FULL BASIN RUNOFF STUDY 5BX1.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

```
  6 IO        OUTPUT CONTROL VARIABLES
                   IPRNT           5  PRINT CONTROL
                   IPLOT           0  PLOT CONTROL
                   QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN           1  MINUTES IN COMPUTATION INTERVAL
                   IDATE     1DEC97   STARTING DATE
                   ITIME        1200  STARTING TIME
                      NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     1DEC97   ENDING DATE
                  NDTIME        1659  ENDING TIME
                   ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL     .02 HOURS
                 TOTAL TIME BASE    4.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	B34	5.	.70	1.	1.	1.	.02		
+	ROUTED TO	J-J	5.	.77	1.	1.	1.	.02		
+									.08	.77
+	HYDROGRAPH AT	500C	1.	.68	0.	0.	0.	.01		
+	2 COMBINED AT	DP345	5.	.75	1.	1.	1.	.04		
+	HYDROGRAPH AT	B5	9.	.72	2.	2.	2.	.04		
+	HYDROGRAPH AT	B6	5.	.72	1.	1.	1.	.02		
+	2 COMBINED AT	DP56	13.	.72	2.	2.	2.	.06		
+	ROUTED TO	K-K	12.	.80	2.	2.	2.	.06		
+									.20	.80
+	HYDROGRAPH AT	500A	2.	.80	0.	0.	0.	.04		
+	3 COMBINED AT	DP500	19.	.78	4.	4.	4.	.14		

+	HYDROGRAPH AT	500B	1.	.68	0.	0.	0.	.01		
+	2 COMBINED AT	DP501	20.	.78	4.	4.	4.	.15		
+	HYDROGRAPH AT	B7	3.	.68	1.	1.	1.	.01		
+	HYDROGRAPH AT	B8-1	12.	.68	2.	2.	2.	.06		
+	HYDROGRAPH AT	B8-2	4.	.65	1.	1.	1.	.02		
+	2 COMBINED AT	DP7	15.	.68	3.	3.	3.	.07		
+	HYDROGRAPH AT	B8-3	4.	.80	1.	1.	1.	.02		
+	3 COMBINED AT	DP7A	22.	.70	4.	4.	4.	.11		
+	HYDROGRAPH AT	400A	1.	1.00	0.	0.	0.	.02		
+	2 COMBINED AT	DP401	22.	.70	4.	4.	4.	.13		
+	HYDROGRAPH AT	400B	0.	.88	0.	0.	0.	.01		
+	2 COMBINED AT	DP402	22.	.70	4.	4.	4.	.14		
+	HYDROGRAPH AT	B1A	6.	.73	1.	1.	1.	.02		
+	HYDROGRAPH AT	B1B	52.	.90	10.	10.	10.	.23		
+	HYDROGRAPH AT	B1C	9.	.83	2.	2.	2.	.04		
+	2 COMBINED AT	DP1BC	61.	.88	12.	12.	12.	.27		
+	ROUTED TO	A-A	60.	.93	12.	12.	12.	.27		
+									.90	.93
+	HYDROGRAPH AT	B1D	18.	.60	2.	2.	2.	.05		
+	2 COMBINED AT	DP1ABC	68.	.93	14.	14.	14.	.32		
+	ROUTED TO	C-C	60.	1.12	14.	14.	14.	.32		
+									1.19	1.12
+	HYDROGRAPH AT	BA	7.	.73	1.	1.	1.	.09		
+	2 COMBINED AT	DP1	63.	1.10	15.	15.	15.	.41		
+	HYDROGRAPH AT	B2	11.	.78	2.	2.	2.	.04		
+	ROUTED TO	D-D	7.	1.23	2.	2.	2.	.04		
+									.19	1.23
+	HYDROGRAPH AT	B2X	1.	.70	0.	0.	0.	.00		
+	ROUTED TO	X-X	1.	.72	0.	0.	0.	.00		

+									.02	.72
+	HYDROGRAPH AT	BC	8.	.67	1.	1.	1.	.09		
+	3 COMBINED AT	DP2	11.	.73	3.	3.	3.	.14		
+	HYDROGRAPH AT	B3	16.	.88	3.	3.	3.	.07		
+	ROUTED TO	E-E	8.	1.47	3.	3.	3.	.07		
+									.36	1.47
+	HYDROGRAPH AT	B4	24.	.82	4.	4.	4.	.10		
+	ROUTED TO	F-F	18.	1.07	4.	4.	4.	.10		
+									.64	1.07
+	HYDROGRAPH AT	BH	3.	.67	0.	0.	0.	.03		
+	3 COMBINED AT	DP3	25.	1.15	8.	8.	8.	.19		
+	HYDROGRAPH AT	BB	2.	.62	0.	0.	0.	.02		
+	HYDROGRAPH AT	BD	2.	.63	0.	0.	0.	.02		

*** NORMAL END OF HEC-1 ***

```
1****************************************                          ****************************************
 *                                      *                          *                                      *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                          *   U.S. ARMY CORPS OF ENGINEERS       *
 *           SEPTEMBER 1990             *                          *   HYDROLOGIC ENGINEERING CENTER      *
 *             VERSION 4.0              *                          *        609 SECOND STREET             *
 *                                      *                          *     DAVIS, CALIFORNIA 95616          *
 *  RUN DATE  02/24/1998  TIME  09:38:00 *                         *          (916) 756-1104              *
 *                                      *                          *                                      *
****************************************                           ****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1          ID       BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
  2          ID       5-YR,2-HR      EXISTING          PART 2
  3          ID       FULL BASIN RUNOFF STUDY         5BX2.DAT
             *DIAGRAM
  4          IT       1 01DEC97    1200    1500
  5          IN       5
  6          IO       5       0

  7          KK      BE
  8          KM       RUNOFF FROM BASIN E
  9          BA    0.01
 10          PB     1.6
 11          PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
 12          PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
 13          PI     .01     .01     .01     .01
 14          LS       0      58       5
 15          UD    0.14

 16          KK      BF
 17          KM       RUNOFF FROM BASIN F
 18          BA    0.01
 19          LS       0      58       5
 20          UD    0.13

 21          KK      BG
 22          KM       RUNOFF FROM BASIN G
 23          BA    0.03
 24          LS       0      58       5
 25          UD    0.19

 26          KK   B12-1
 27          KM       RUNOFF FROM SDA 12-1
 28          BA    .089
 29          LS       0      76       6
 30          UD    .126

 31          KK   B12-2
 32          KM       RUNOFF FROM SDA 12-2
 33          BA    .028
 34          LS       0      76       6
 35          UD    .113
```

```
  36          KK     DP1
  37          KM        COMBINE FLOWS FROM SDAs 12-1, 12-2
  38          HC        2

  39          KK     A-A
  40          KM        ROUTE FLOWS FROM CP1 TO CP2
  41          RS        1    STOR       0
  42          RC     0.12     .08    0.12     630    0.24
  43          RX        0       5      10      20      28      38      43      48
  44          RY       15    12.5      10       0       0      10    12.5      15
1                                           HEC-1 INPUT                                          PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  45          KK   B12-3
  46          KM        RUNOFF FROM SDA 12-3
  47          BA    .027
  48          LS        0      76       6
  49          UD    .145

  50          KK   B12-4
  51          KM        RUNOFF FROM SDA 12-4
  52          BA    .038
  53          LS        0      75       6
  54          UD    .110

  55          KK   B12-7
  56          KM        RUNOFF FROM SDA 12-7
  57          BA    .016
  58          LS        0      75       5
  59          UD    .134

  60          KK     DP2
  61          KM        COMBINE CP1 & SDAs 12-3, 12-4, 12-7
  62          HC        4

  63          KK     B-B
  64          KM        ROUTE FLOWS FROM CP2 TO CP3
  65          RS        1    STOR       0
  66          RC     0.12     .08    0.12     790    0.19
  67          RX        0       5      10      20      28      38      43      48
  68          RY       15    12.5      10       0       0      10    12.5      15

  69          KK   B12-5
  70          KM        RUNOFF FROM SDA 12-5
  71          BA    .081
  72          LS        0      76      10
  73          UD    .154

  74          KK   B12-8
  75          KM        RUNOFF FROM SDA 12-8
  76          BA    .023
  77          LS        0      75       5
  78          UD    .077

  79          KK     DP3
  80          KM        COMBINE FLOWS FROM CP2 & SDAs 12-5, 12-8
  81          HC        3

  82          KK     C-C
  83          KM        ROUTE FLOW FROM CP3 TO CP4
  84          RS        1    STOR       0
  85          RC     0.12     .08    0.12     650    0.26
  86          RX        0       5      10      20      28      38      43      48
  87          RY       15    12.5      10       0       0      10    12.5      15
1                                           HEC-1 INPUT                                          PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  88          KK   B12-6
  89          KM        RUNOFF FROM SDA 12-6
  90          BA    .061
  91          LS        0      76      10
  92          UD    .129

  93          KK   B12-9
  94          KM        RUNOFF FROM SDA 12-9
```

```
 95     BA    .021
 96     LS      0      75      4
 97     UD    .112

 98     KK     DP4
 99     KM        COMBINE FLOWS FROM CP3 & SDAs 12-6, 12-9
100     HC      3

101     KK     D-D
102     KM        ROUTE FLOWS FROM CP4 TO CP5
103     RS      1     STOR      0
104     RC    0.12     .08    0.12    1420    0.19
105     RX      0       5      10      20      28      38      43      48
106     RY     15    12.5      10       0       0      10    12.5      15

107     KK   B1210
108     KM        RUNOFF FROM SDA 12-10
109     BA    .069
110     LS      0      75      5
111     UD    .170

112     KK     DP5
113     KM        COMBINE FLOWS FROM CP4 & SDA 1210
114     HC      2

115     KK     E-E
116     KM        ROUTE FLOW FROM CP5 TO CP6
117     RS      1     STOR      0
118     RC    0.12     .08    0.12    1420    0.11
119     RX      0       5      10      20      28      38      43      48
120     RY     15    12.5      10       0       0      10    12.5      15

121     KK   B1211
122     KM        RUNOFF FROM SDA 12-11
123     BA    .041
124     LS      0      74     10
125     UD    .073

126     KK     DP6
127     KM        COMBINE DP5 & 1211
128     HC      2
```



```
LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

129     KK     F-F
130     KM        ROUTE FLOW FROM 12-11 TO 1011-1
131     RS      1     STOR      0
132     RC    0.12     .08    0.12    1200     .13
133     RX      0       5      10      20      28      38      43      48
134     RY     15    12.5      10       0       0      10    12.5      15

135     KK  B10111
136     KM        RUNOFF FROM SDA 1011-1
137     BA    .035
138     LS      0      74      7
139     UD    .160

140     KK  B10112
141     KM        RUNOFF FROM SDA 1011-2
142     BA    .037
143     LS      0      74      7
144     UD    .160

145     KK     DP8
146     KM        COMBINE FLOW FROM SDA 1012 & CP6A
147     HC      3

148     KK     G-G
149     KM        ROUTE FLOW FROM DP8 TO DP300
150     RS      1     STOR      0
151     RC    0.12     .08    0.12    1200     .12
152     RX      0       5      10      20      28      38      43      48
153     RY     15    12.5      10       0       0      10    12.5      15

154     KK    300A
155     KM        RUNOFF FROM 300A
156     BA    .049
157     LS      0      58      4
```

```
 158          UD    .313

 159          KK   DP300
 160          KM        COMBINE FLOWS FROM CP8 & SDA 300A
 161          HC       2

 162          KK      B9
 163          KM        RUNOFF FROM SDA 9
 164          BA    .085
 165          LS       0      74       4
 166          UD    .125

 167          KK     H-H
 168          KM        ROUTE FLOW FROM B9 THRU SDA 300B
 169          RS       1    STOR       0
 170          RC    0.12     .08    0.12    1200     .25
 171          RX       0       5      10      20      28      38      43      48
 172          RY      15    12.5      10       0       0      10    12.5      15
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 173          KK    300B
 174          KM        RUNOFF FROM 300B
 175          BA    .026
 176          LS       0      58       4
 177          UD    .247

 178          KK     DP9
 179          KM        COMBINE SDA B9 & 300B
 180          HC       2

 181          KK   DP301
 182          KM        COMBINE FLOWS FROM CP300 & SDA 300B
 183          HC       2

 184          KK     I-I
 185          KM        ROUTE FLOW FROM B9 THRU SDA 300B
 186          RS       1    STOR       0
 187          RC    0.12     .08    0.12    1800     .17
 188          RX       0       4     5.5     6.5    14.5    15.5      17      21
 189          RY       7       5       2       0       0       2       5       7

 190          KK    300C
 191          KM        RUNOFF FROM SDA 300C
 192          BA     .06
 193          LS       0      58       4
 194          UD    .288

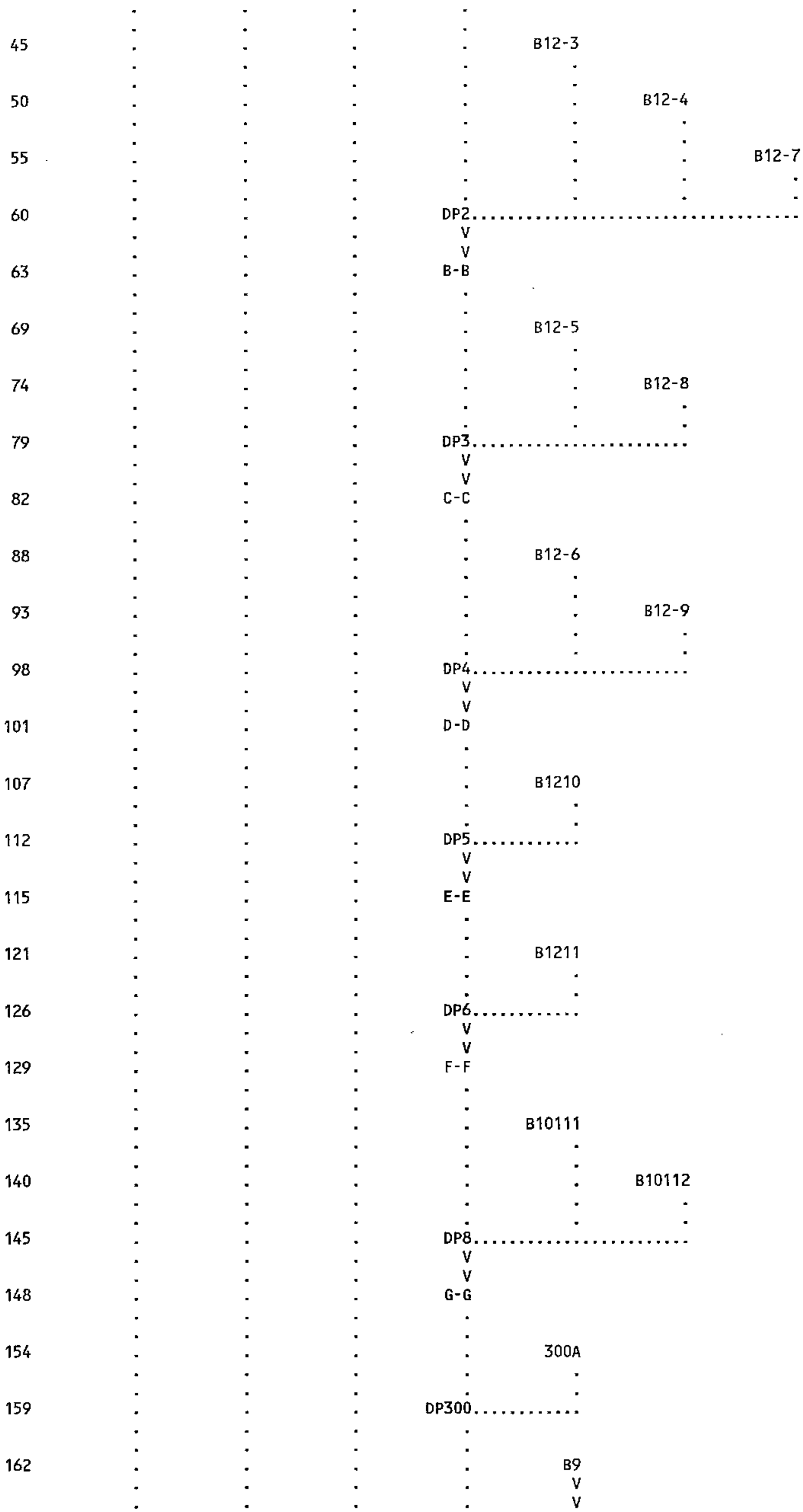
 195          KK   DP302
 196          KM        COMBINE FLOWS FROM CP301 & 300C
 197          HC       2
 198          ZZ
```

1

```
             SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7         BE
              .
              .
  16          .          BF
              .           .
              .           .
  21          .           .           BG
              .           .            .
              .           .            .
  26          .           .            .       B12-1
              .           .            .           .
              .           .            .           .
  31          .           .            .           .          B12-2
              .           .            .           .              .
              .           .            .           .              .
  36          .           .            .         DP1............
              .           .            .           V
              .           .            .           V
  39          .           .            .         A-A
```



45
50
55
60
63
69
74
79
82
88
93
98
101
107
112
115
121
126
129
135
140
145
148
154
159
162
B12-3
B12-4
B12-7
DP2
V
V
B-B
B12-5
B12-8
DP3
V
V
C-C
B12-6
B12-9
DP4
V
V
D-D
B1210
DP5
V
V
E-E
B1211
DP6
V
V
F-F
B10111
B10112
DP8
V
V
G-G
300A
DP300
B9
V
V

```
167        .         .         .         .        H-H
           .         .         .         .         .
           .         .         .         .         .
173        .         .         .         .         .        300B
           .         .         .         .         .         .
           .         .         .         .         .         .
178        .         .         .         .        DP9...........
           .         .         .         .         .
           .         .         .         .         .
181        .         .         .       DP301...........
           .         .         .         V
           .         .         .         V
184        .         .         .        I-I
           .         .         .         .
           .         .         .         .
190        .         .         .         .        300C
           .         .         .         .         .
           .         .         .         .         .
195        .         .         .       DP302...........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************                              **************************************
 *                                       *                              *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                              *   U.S. ARMY CORPS OF ENGINEERS     *
 *            SEPTEMBER 1990             *                              *   HYDROLOGIC ENGINEERING CENTER    *
 *             VERSION 4.0               *                              *        609 SECOND STREET           *
 *                                       *                              *      DAVIS, CALIFORNIA 95616       *
 *  RUN DATE  02/24/1998  TIME  09:38:00 *                              *          (916) 756-1104            *
 *                                       *                              *                                    *
 ****************************************                               **************************************
```

```
                              BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
                              5-YR,2-HR       EXISTING         PART 2
                              FULL BASIN RUNOFF STUDY         5BX2.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

   6 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           1  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1DEC97  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1DEC97  ENDING DATE
                      NDTIME        1659  ENDING TIME
                       ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE    4.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BE	1.	.62	0.	0.	0.	.01		
+	HYDROGRAPH AT	BF	1.	.60	0.	0.	0.	.01		

+	HYDROGRAPH AT	BG	3.	.67	0.	0.	0.	.03		
+	HYDROGRAPH AT	B12-1	22.	.70	4.	4.	4.	.09		
+	HYDROGRAPH AT	B12-2	7.	.68	1.	1.	1.	.03		
+	2 COMBINED AT	DP1	29.	.70	5.	5.	5.	.12		
+	ROUTED TO	A-A	28.	.73	5.	5.	5.	.12		
+									.46	.73
+	HYDROGRAPH AT	B12-3	6.	.73	1.	1.	1.	.03		
+	HYDROGRAPH AT	B12-4	9.	.68	1.	1.	1.	.04		
+	HYDROGRAPH AT	B12-7	3.	.73	1.	1.	1.	.02		
+	4 COMBINED AT	DP2	46.	.72	8.	8.	8.	.20		
+	ROUTED TO	B-B	46.	.75	8.	8.	8.	.20		
+									.81	.75
+	HYDROGRAPH AT	B12-5	23.	.72	4.	4.	4.	.08		
+	HYDROGRAPH AT	B12-8	5.	.65	1.	1.	1.	.02		
+	3 COMBINED AT	DP3	73.	.73	12.	12.	12.	.30		
+	ROUTED TO	C-C	73.	.75	12.	12.	12.	.30		
+									.94	.75
+	HYDROGRAPH AT	B12-6	18.	.68	3.	3.	3.	.06		
+	HYDROGRAPH AT	B12-9	4.	.72	1.	1.	1.	.02		
+	3 COMBINED AT	DP4	94.	.75	16.	16.	16.	.38		
+	ROUTED TO	D-D	92.	.78	16.	16.	16.	.38		
+									1.19	.78
+	HYDROGRAPH AT	B1210	13.	.78	2.	2.	2.	.07		
+	2 COMBINED AT	DP5	105.	.78	18.	18.	18.	.45		
+	ROUTED TO	E-E	102.	.83	18.	18.	18.	.45		
+									1.53	.83
+	HYDROGRAPH AT	B1211	11.	.62	2.	2.	2.	.04		
+	2 COMBINED AT	DP6	109.	.82	20.	20.	20.	.49		
+	ROUTED TO	F-F	108.	.87	20.	20.	20.	.49		
+									1.50	.87
	HYDROGRAPH AT									

+		B10111	7.	.75	1.	1.	1.	.04		
+	HYDROGRAPH AT	B10112	7.	.75	1.	1.	1.	.04		
+	3 COMBINED AT	DP8	121.	.85	23.	23.	23.	.57		
+	ROUTED TO	G-G	120.	.88	23.	23.	23.	.57		
+									1.64	.88
+	HYDROGRAPH AT	300A	3.	.80	0.	0.	0.	.05		
+	2 COMBINED AT	DP300	122.	.88	23.	23.	23.	.62		
+	HYDROGRAPH AT	B9	15.	.73	3.	3.	3.	.09		
+	ROUTED TO	H-H	14.	.78	3.	3.	3.	.09		
+									.22	.78
+	HYDROGRAPH AT	300B	2.	.72	0.	0.	0.	.03		
+	2 COMBINED AT	DP9	16.	.78	3.	3.	3.	.11		
+	2 COMBINED AT	DP301	136.	.88	26.	26.	26.	.73		
+	ROUTED TO	I-I	134.	.92	26.	26.	26.	.73		
+									1.68	.92
+	HYDROGRAPH AT	300C	3.	.77	1.	1.	1.	.06		
+	2 COMBINED AT	DP302	137.	.92	27.	27.	27.	.79		

*** NORMAL END OF HEC-1 ***

```
1***************************************                                          ****************************************
 *                                      *                                          *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN 09 1992              *                                          *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.0.3E             *                                          *        609 SECOND STREET             *
 *                                      *                                          *    DAVIS, CALIFORNIA 95616           *
 * RUN DATE  02/24/98  TIME  09:45:17   *                                          *        (916) 551-1748                *
 *                                      *                                          *                                      *
****************************************                                          ****************************************


                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                          HEC-1 INPUT                                                     PAGE  1

         LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1         ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
           2         ID         100YR,2HR      EXISTING          PART 1
           3         ID        FULL BASIN RUNOFF STUDY          100BX1.DAT
                     *DIAGRAM
           4         IT       1 01DEC97     1200     1500
           5         IN       5
           6         IO       5       0

           7         KK     B34
           8         KM        RUNOFF FROM SDA        34
           9         BA    .023
          10         PB     3.1
          11         PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
          12         PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
          13         PI     .01     .01     .01     .01
          14         LS       0      74       7
          15         UD    .125

          16         KK     J-J
          17         KM        ROUTE FLOW FROM B3 THRU 500C
          18         RS       1    STOR       0
          19         RC    0.12     .08    0.12    1500     .21
          20         RX       0       5      10      20      28      38      43      48
          21         RY      15    12.5      10       0       0      10    12.5      15

          22         KK    500C
          23         KM         RUNOFF FROM 500C
          24         BA    .015
          25         LS       0      58       4
          26         UD    .208

          27         KK   DP345
          28         KM        COMBINE SDAs 34 & 500C
          29         HC       2

          30         KK      B5
          31         KM        RUNOFF FROM SDA 5
          32         BA    .042
          33         LS       0      74       7
          34         UD    .131
```

```
 35        KK     B6
 36        KM        RUNOFF FROM SDA 6
 37        BA    .022
 38        LS       0      74       7
 39        UD    .131

 40        KK    DP56
 41        KM        COMBINE FLOWS FROM SDAs 5&6
 42        HC       2
1                                HEC-1 INPUT                                              PAGE  2

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 43        KK     K-K
 44        KM        ROUTE FLOW FROM DP 56 THRU 500A
 45        RS       1    STOR       0
 46        RC    0.12     .08    0.12    2100     .22
 47        RX       0       5      10      20      28      38      43      48
 48        RY      15    12.5      10       0       0      10    12.5      15

 49        KK    500A
 50        KM        RUNOFF FROM SDA 500A
 51        BA    .036
 52        LS       0      58       4
 53        UD    .313

 54        KK   DP500
 55        KM        COMBINE FLOWS FROM CP56&500A
 56        HC       3

 57        KK    500B
 58        KM        RUNOFF FROM SDA 500B
 59        BA    .009
 60        LS       0      58       4
 61        UD    .208

 62        KK   DP501
 63        KM        COMBINE FLOWS FROM CP5A&500B
 64        HC       2

 65        KK     B7
 66        KM        RUNOFF FROM SDA 7
 67        BA    .014
 68        LS       0      74       7
 69        UD    .107

 70        KK    B8-1
 71        KM        RUNOFF FROM SDA 8-1
 72        BA    .056
 73        LS       0      74       7
 74        UD    .113

 75        KK    B8-2
 76        KM        RUNOFF FROM SDA 8-2
 77        BA    .016
 78        LS       0      74       7
 79        UD    .086

 80        KK     DP7
 81        KM        COMBINE FLOWS FROM SDAs 8-1, 8-2
 82        HC       2
1                                HEC-1 INPUT                                              PAGE  3

LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 83        KK    B8-3
 84        KM        RUNOFF FROM SDA 8-3
 85        BA    .021
 86        LS       0      74       7
 87        UD    .202

 88        KK    DP7A
 89        KM        COMBINE FLOW FROM CP7 & SDA 8-3 &B7
 90        HC       3

 91        KK    400A
 92        KM        RUNOFF FROM SDA     400A
 93        BA     .02
```

```
 94      LS      0      58       4
 95      UD   .506

 96      KK  DP401
 97      KM        COMBINE FLOWS FROM DP7A & SDA 400A
 98      HC      2

 99      KK   400B
100      KM        RUNOFF FROM SDA     400B
101      BA    .01
102      LS      0      58       4
103      UD   .406

104      KK  DP402
105      KM        COMBINE FLOWS FROM DP402& SDA 400B
106      HC      2

107      KK    B1A
108      KM        RUNOFF FROM BASIN 1A
109      BA  0.023
110      LS      0      78       5
111      UD   0.15

112      KK    B1B
113      KM        RUNOFF FROM BASIN 1B
114      BA  0.231
115      LS      0      78       5
116      UD   0.27

117      KK    B1C
118      KM        RUNOFF FROM BASIN 1C
119      BA  0.037
120      LS      0      78       5
121      UD   0.22

122      KK  DP1BC
123      KM        COMBINE FLOWS FROM BASIN 1B & 1C
124      HC      2
```



```
LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

125      KK    A-A
126      KM        ROUTE FLOW FROM DP1BC THRU BASIN 1D
127      RS      1    STOR       0
128      RC   0.12    0.08    0.12    1600    0.21
129      RX      0       5      10      20      28      38      43      48
130      RY     15    12.5      10       0       0      10    12.5      15

131      KK    B1D
132      KM        RUNOFF FROM BASIN 1D
133      BA  0.050
134      LS      0      78       5
135      UD   0.04

136      KK DP1ABCD
137      KM        COMBINE FLOWS FROM BASINS 1A THRU 1D
138      HC      2

139      KK    C-C
140      KM        ROUTE FLOW FROM BASINS 1A-1D THRU BASIN A
141      RS      1    STOR       0
142      RC   0.12    0.08    0.12    4000     .08
143      RX      0       5      10      20      28      38      43      48
144      RY     15    12.5      10       0       0      10    12.5      15

145      KK     BA
146      KM        RUNOFF FROM BASIN A
147      BA   0.09
148      LS      0      58       5
149      UD   0.25

150      KK    DP1
151      KM        COMBINE FLOWS FROM BASINS 1A-1D & BASIN A
152      HC      2

153      KK     B2
154      KM        RUNOFF FROM BASIN 2
155      BA  0.043
```

```
 156            LS      0      78       5
 157            UD   0.19

 158            KK     D-D
 159            KM       ROUTE FLOW FROM BASIN 2 THRU BASIN C
 160            RS      1    STOR       0
 161            RC   0.12    0.08    0.12    6400    0.07
 162            RX      0       5      10      20      28      38      43      48
 163            RY     15    12.5      10       0       0      10    12.5      15

 164            KK     B2X
 165            KM       RUNOFF FROM BASIN 2X
 166            BA   .005
 167            LS      0      78       5
 168            UD   0.13
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 169            KK     X-X
 170            KM       ROUTE FLOW FROM BASIN 2XTHRU BASIN C
 171            RS      1    STOR       0
 172            RC   0.12    0.08    0.12     490    0.49
 173            RX      0       5      10      20      28      38      43      48
 174            RY     15    12.5      10       0       0      10    12.5      15

 175            KK      BC
 176            KM       RUNOFF FROM BASIN C
 177            BA   0.09
 178            LS      0      58       5
 179            UD   0.19

 180            KK     DP2
 181            KM       COMBINE FLOWS FROM BASINS 2,2X & C
 182            HC      3

 183            KK      B3
 184            KM       RUNOFF FROM BASIN 3
 185            BA 0.0687
 186            LS      0      78       5
 187            UD   0.26

 188            KK     E-E
 189            KM       ROUTE FLOW FROM BASIN 3 THRU BASIN H
 190            RS      1    STOR       0
 191            RC   0.12    0.08    0.12    7200    0.03
 192            RX      0       5      10      20      28      38      43      48
 193            RY     15    12.5      10       0       0      10    12.5      15

 194            KK      B4
 195            KM       RUNOFF FROM BASIN 4
 196            BA  0.096
 197            LS      0      78       5
 198            UD   0.21

 199            KK     F-F
 200            KM       ROUTE FLOW FROM BASIN 4 THRU BASIN H
 201            RS      1    STOR       0
 202            RC   0.12    0.08    0.12    2800    0.05
 203            RX      0       5      10      20      28      38      43      48
 204            RY     15    12.5      10       0       0      10    12.5      15

 205            KK      BH
 206            KM       RUNOFF FROM BASIN H
 207            BA   0.03
 208            LS      0      58       5
 209            UD   0.19
```



```
LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 210            KK     DP3
 211            KM       COMBINE FLOWS FROM BASINS 3, 4 & H
 212            HC      3

 213            KK      BB
 214            KM       RUNOFF FROM BASIN B
 215            BA   0.02
```

```
            216           LS       0       58       5
            217           UD    0.15

            218           KK      BD
            219           KM        RUNOFF FROM BASIN D
            220           BA    0.02
            221           LS       0       58       5
            222           UD    0.16
            223           ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     7         B34
                 V
                 V
    16         J-J
                 .
                 .
    22           .        500C
                 .           .
                 .           .
    27       DP345............
                 .
                 .
    30           .          B5
                 .           .
                 .           .
    35           .           .          B6
                 .           .           .
                 .           .           .
    40           .        DP56............
                 .           V
                 .           V
    43           .         K-K
                 .           .
                 .           .
    49           .           .        500A
                 .           .           .
                 .           .           .
    54       DP500........................
                 .
                 .
    57           .        500B
                 .           .
                 .           .
    62       DP501............
                 .
                 .
    65           .          B7
                 .           .
                 .           .
    70           .           .        B8-1
                 .           .           .
                 .           .           .
    75           .           .           .        B8-2
                 .           .           .           .
                 .           .           .           .
    80           .           .         DP7............
                 .           .           .
                 .           .           .
    83           .           .           .        B8-3
                 .           .           .           .
                 .           .           .           .
    88           .        DP7A........................
                 .           .
                 .           .
    91           .           .        400A
                 .           .           .
                 .           .           .
    96           .       DP401............
                 .           .
                 .           .
    99           .           .        400B
                 .           .           .
                 .           .           .
   104           .       DP402............
```

```
              .           .
              .           .
107           .           .         B1A
              .           .           .
              .           .           .
112           .           .           .         B1B
              .           .           .           .
              .           .           .           .
117           .           .           .           .         B1C
              .           .           .           .           .
              .           .           .           .           .
122           .           .           .       DP1BC............
              .           .           .           V
              .           .           .           V
125           .           .           .         A-A
              .           .           .           .
              .           .           .           .
131           .           .           .           .         B1D
              .           .           .           .           .
              .           .           .           .           .
136           .           .           .      DP1ABC............
              .           .           .           V
              .           .           .           V
139           .           .           .         C-C
              .           .           .           .
              .           .           .           .
145           .           .           .           .          BA
              .           .           .           .           .
              .           .           .           .           .
150           .           .           .         DP1............
              .           .           .           .
              .           .           .           .
153           .           .           .           .          B2
              .           .           .           .           V
              .           .           .           .           V
158           .           .           .           .         D-D
              .           .           .           .           .
              .           .           .           .           .
164           .           .           .           .           .         B2X
              .           .           .           .           .           V
              .           .           .           .           .           V
169           .           .           .           .           .         X-X
              .           .           .           .           .           .
              .           .           .           .           .           .
175           .           .           .           .           .           .          BC
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
180           .           .           .           .         DP2........................
              .           .           .           .           .
              .           .           .           .           .
183           .           .           .           .           .          B3
              .           .           .           .           .           V
              .           .           .           .           .           V
188           .           .           .           .           .         E-E
              .           .           .           .           .           .
              .           .           .           .           .           .
194           .           .           .           .           .           .          B4
              .           .           .           .           .           .           V
              .           .           .           .           .           .           V
199           .           .           .           .           .           .         F-F
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
205           .           .           .           .           .           .           .          BH
              .           .           .           .           .           .           .           .
              .           .           .           .           .           .           .           .
210           .           .           .           .           .         DP3........................
              .           .           .           .           .           .
              .           .           .           .           .           .
213           .           .           .           .           .           .          BB
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
218           .           .           .           .           .           .           .          BD
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************                                      ****************************************
 *                                       *                                      *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                      *     U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN 09 1992               *                                      *     HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.0.3E              *                                      *          609 SECOND STREET           *
 *                                       *                                      *        DAVIS, CALIFORNIA 95616       *
```

BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
100YR,2HR EXISTING PART 1
FULL BASIN RUNOFF STUDY 100BX1.DAT

```
  6 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN          1  MINUTES IN COMPUTATION INTERVAL
                   IDATE     1DEC97  STARTING DATE
                   ITIME       1200  STARTING TIME
                      NQ       1500  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     2DEC97  ENDING DATE
                  NDTIME       1259  ENDING TIME
                   ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL    0.02 HOURS
                   TOTAL TIME BASE   24.98 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	B34	26.	0.65	3.	1.	1.	0.02		
+	ROUTED TO	J-J	24.	0.73	3.	1.	1.	0.02		
+									0.41	0.73
+	HYDROGRAPH AT	500C	4.	0.87	1.	0.	0.	0.01		
+	2 COMBINED AT	DP345	27.	0.73	3.	1.	1.	0.04		
+	HYDROGRAPH AT	B5	47.	0.67	5.	1.	1.	0.04		
+	HYDROGRAPH AT	B6	25.	0.67	3.	1.	1.	0.02		
+	2 COMBINED AT	DP56	72.	0.67	8.	2.	2.	0.06		
+	ROUTED TO	K-K	66.	0.73	8.	2.	2.	0.06		
+									0.94	0.73
+	HYDROGRAPH AT	500A	8.	1.02	2.	0.	0.	0.04		
+	3 COMBINED AT	DP500	98.	0.73	13.	3.	3.	0.14		
+	HYDROGRAPH AT	500B	2.	0.87	0.	0.	0.	0.01		

+	2 COMBINED AT	DP501	100.	0.73	13.	3.	3.	0.15		
+	HYDROGRAPH AT	B7	17.	0.63	2.	0.	0.	0.01		
+	HYDROGRAPH AT	B8-1	66.	0.65	7.	2.	2.	0.06		
+	HYDROGRAPH AT	B8-2	20.	0.60	2.	0.	0.	0.02		
+	2 COMBINED AT	DP7	86.	0.63	9.	2.	2.	0.07		
+	HYDROGRAPH AT	B8-3	20.	0.77	3.	1.	1.	0.02		
+	3 COMBINED AT	DP7A	117.	0.65	13.	3.	3.	0.11		
+	HYDROGRAPH AT	400A	4.	1.32	1.	0.	0.	0.02		
+	2 COMBINED AT	DP401	118.	0.65	14.	3.	3.	0.13		
+	HYDROGRAPH AT	400B	2.	1.17	0.	0.	0.	0.01		
+	2 COMBINED AT	DP402	119.	0.65	14.	4.	3.	0.14		
+	HYDROGRAPH AT	B1A	30.	0.68	3.	1.	1.	0.02		
+	HYDROGRAPH AT	B1B	234.	0.83	32.	8.	8.	0.23		
+	HYDROGRAPH AT	B1C	41.	0.77	5.	1.	1.	0.04		
+	2 COMBINED AT	DP1BC	273.	0.83	37.	9.	9.	0.27		
+	ROUTED TO	A-A	271.	0.87	37.	9.	9.	0.27		
+									2.24	0.87
+	HYDROGRAPH AT	B1D	93.	0.52	7.	2.	2.	0.05		
+	2 COMBINED AT	DP1ABC	302.	0.85	44.	11.	11.	0.32		
+	ROUTED TO	C-C	275.	0.95	44.	11.	11.	0.32		
+									2.98	0.95
+	HYDROGRAPH AT	BA	24.	0.92	4.	1.	1.	0.09		
+	2 COMBINED AT	DP1	299.	0.95	49.	12.	12.	0.41		
+	HYDROGRAPH AT	B2	51.	0.73	6.	1.	1.	0.04		
+	ROUTED TO	D-D	26.	1.08	6.	1.	1.	0.04		
+									0.79	1.08
+	HYDROGRAPH AT	B2X	7.	0.65	1.	0.	0.	0.00		
+	ROUTED TO	X-X	7.	0.67	1.	0.	0.	0.00		
+									0.08	0.67

	HYDROGRAPH AT									
+		BC	25.	0.83	4.	1.	1.	0.09		
	3 COMBINED AT									
+		DP2	52.	0.90	11.	3.	3.	0.14		
	HYDROGRAPH AT									
+		B3	70.	0.83	9.	2.	2.	0.07		
	ROUTED TO									
+		E-E	37.	1.27	9.	2.	2.	0.07		
+									1.20	1.27
	HYDROGRAPH AT									
+		B4	109.	0.77	13.	3.	3.	0.10		
	ROUTED TO									
+		F-F	92.	0.88	13.	3.	3.	0.10		
+									1.80	0.88
	HYDROGRAPH AT									
+		BH	8.	0.83	1.	0.	0.	0.03		
	3 COMBINED AT									
+		DP3	124.	0.95	24.	6.	6.	0.19		
	HYDROGRAPH AT									
+		BB	6.	0.77	1.	0.	0.	0.02		
	HYDROGRAPH AT									
+		BD	6.	0.78	1.	0.	0.	0.02		

*** NORMAL END OF HEC-1 ***

```
1****************************************                            ****************************************
 *                                      *                            *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                            *   U.S. ARMY CORPS OF ENGINEERS       *
 *            SEPTEMBER 1990            *                            *   HYDROLOGIC ENGINEERING CENTER      *
 *             VERSION 4.0              *                            *         609 SECOND STREET            *
 *                                      *                            *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  02/24/1998  TIME  09:41:35 *                           *          (916) 756-1104              *
 *                                      *                            *                                      *
****************************************                            ****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1          ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
  2          ID         100YR,2HR      EXISTING         PART 2
  3          ID        FULL BASIN RUNOFF STUDY         100BX2.DAT
             *DIAGRAM
  4          IT        1 01DEC97    1200    1500
  5          IN        5
  6          IO        5       0

  7          KK      BE
  8          KM        RUNOFF FROM BASIN E
  9          BA     0.01
 10          PB      3.1
 11          PI      .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
 12          PI      .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
 13          PI      .01     .01     .01     .01
 14          LS        0      58       5
 15          UD     0.14

 16          KK      BF
 17          KM        RUNOFF FROM BASIN F
 18          BA     0.01
 19          LS        0      58       5
 20          UD     0.13

 21          KK      BG
 22          KM        RUNOFF FROM BASIN G
 23          BA     0.03
 24          LS        0      58       5
 25          UD     0.19

 26          KK   B12-1
 27          KM        RUNOFF FROM SDA 12-1
 28          BA     .089
 29          LS        0      76       6
 30          UD     .126

 31          KK   B12-2
 32          KM        RUNOFF FROM SDA 12-2
 33          BA     .028
 34          LS        0      76       6
 35          UD     .113
```

```
 36          KK     DP1
 37          KM        COMBINE FLOWS FROM SDAs 12-1, 12-2
 38          HC       2

 39          KK     A-A
 40          KM        ROUTE FLOWS FROM CP1 TO CP2
 41          RS       1    STOR       0
 42          RC    0.12     .08    0.12     630    0.24
 43          RX       0       5      10      20      28      38      43      48
 44          RY      15    12.5      10       0       0      10    12.5      15
1                                    HEC-1 INPUT                                            PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 45          KK   B12-3
 46          KM        RUNOFF FROM SDA 12-3
 47          BA    .027
 48          LS       0      76       6
 49          UD    .145

 50          KK   B12-4
 51          KM        RUNOFF FROM SDA 12-4
 52          BA    .038
 53          LS       0      75       6
 54          UD    .110

 55          KK   B12-7
 56          KM        RUNOFF FROM SDA 12-7
 57          BA    .016
 58          LS       0      75       5
 59          UD    .134

 60          KK     DP2
 61          KM        COMBINE CP1 & SDAs 12-3, 12-4, 12-7
 62          HC       4

 63          KK     B-B
 64          KM        ROUTE FLOWS FROM CP2 TO CP3
 65          RS       1    STOR       0
 66          RC    0.12     .08    0.12     790    0.19
 67          RX       0       5      10      20      28      38      43      48
 68          RY      15    12.5      10       0       0      10    12.5      15

 69          KK   B12-5
 70          KM        RUNOFF FROM SDA 12-5
 71          BA    .081
 72          LS       0      76      10
 73          UD    .154

 74          KK   B12-8
 75          KM        RUNOFF FROM SDA 12-8
 76          BA    .023
 77          LS       0      75       5
 78          UD    .077

 79          KK     DP3
 80          KM        COMBINE FLOWS FROM CP2 & SDAs 12-5, 12-8
 81          HC       3

 82          KK     C-C
 83          KM        ROUTE FLOW FROM CP3 TO CP4
 84          RS       1    STOR       0
 85          RC    0.12     .08    0.12     650    0.26
 86          RX       0       5      10      20      28      38      43      48
 87          RY      15    12.5      10       0       0      10    12.5      15
1                                    HEC-1 INPUT                                            PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 88          KK   B12-6
 89          KM        RUNOFF FROM SDA 12-6
 90          BA    .061
 91          LS       0      76      10
 92          UD    .129

 93          KK   B12-9
 94          KM        RUNOFF FROM SDA 12-9
```

```
BA    .021
LS      0      75       4
UD    .112

KK     DP4
KM        COMBINE FLOWS FROM CP3 & SDAs 12-6, 12-9
HC       3

KK     D-D
KM        ROUTE FLOWS FROM CP4 TO CP5
RS       1     STOR       0
RC    0.12     .08     0.12    1420    0.19
RX       0       5       10      20      28      38      43      48
RY      15    12.5       10       0       0      10    12.5      15

KK   B1210
KM        RUNOFF FROM SDA 12-10
BA    .069
LS      0      75       5
UD    .170

KK     DP5
KM        COMBINE FLOWS FROM CP4 & SDA 1210
HC       2

KK     E-E
KM        ROUTE FLOW FROM CP5 TO CP6
RS       1     STOR       0
RC    0.12     .08     0.12    1420    0.11
RX       0       5       10      20      28      38      43      48
RY      15    12.5       10       0       0      10    12.5      15

KK   B1211
KM        RUNOFF FROM SDA 12-11
BA    .041
LS      0      74      10
UD    .073

KK     DP6
KM        COMBINE DP5 & 1211
HC       2
```



```
LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK     F-F
KM        ROUTE FLOW FROM 12-11 TO 1011-1
RS       1     STOR       0
RC    0.12     .08     0.12    1200     .13
RX       0       5       10      20      28      38      43      48
RY      15    12.5       10       0       0      10    12.5      15

KK  B10111
KM        RUNOFF FROM SDA 1011-1
BA    .035
LS      0      74       7
UD    .160

KK  B10112
KM        RUNOFF FROM SDA 1011-2
BA    .037
LS      0      74       7
UD    .160

KK     DP8
KM        COMBINE FLOW FROM SDA 1012 & CP6A
HC       3

KK     G-G
KM        ROUTE FLOW FROM DP8 TO DP300
RS       1     STOR       0
RC    0.12     .08     0.12    1200     .12
RX       0       5       10      20      28      38      43      48
RY      15    12.5       10       0       0      10    12.5      15

KK    300A
KM        RUNOFF FROM 300A
BA    .049
LS      0      58       4
```

```
 158           UD    .313

 159           KK   DP300
 160           KM        COMBINE FLOWS FROM CP8 & SDA 300A
 161           HC       2

 162           KK      B9
 163           KM        RUNOFF FROM SDA 9
 164           BA    .085
 165           LS       0      74       4
 166           UD    .125

 167           KK     H-H
 168           KM        ROUTE FLOW FROM B9 THRU SDA 300B
 169           RS       1    STOR       0
 170           RC    0.12     .08    0.12    1200     .25
 171           RX       0       5      10      20      28      38      43      48
 172           RY      15    12.5      10       0       0      10    12.5      15
```



```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 173           KK    300B
 174           KM        RUNOFF FROM 300B
 175           BA    .026
 176           LS       0      58       4
 177           UD    .247

 178           KK     DP9
 179           KM        COMBINE SDA B9 & 300B
 180           HC       2

 181           KK   DP301
 182           KM        COMBINE FLOWS FROM CP300 & SDA 300B
 183           HC       2

 184           KK     I-I
 185           KM        ROUTE FLOW FROM B9 THRU SDA 300B
 186           RS       1    STOR       0
 187           RC    0.12     .08    0.12    1800     .17
 188           RX       0       4     5.5     6.5    14.5    15.5      17      21
 189           RY       7       5       2       0       0       2       5       7

 190           KK    300C
 191           KM        RUNOFF FROM SDA 300C
 192           BA     .06
 193           LS       0      58       4
 194           UD    .288

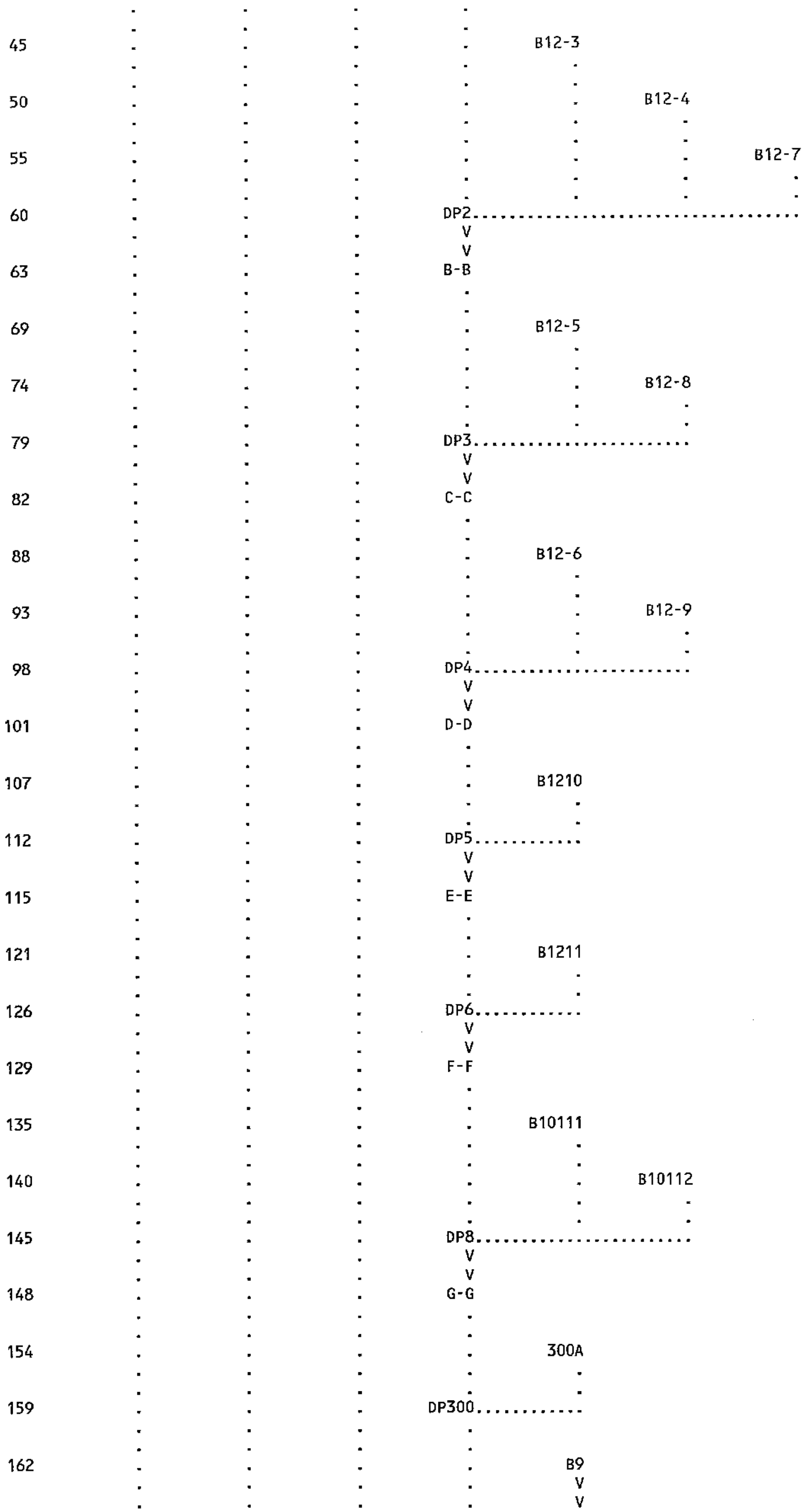
 195           KK   DP302
 196           KM        COMBINE FLOWS FROM CP301 & 300C
 197           HC       2
 198           ZZ
```

1

```
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE    (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

 NO.     (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7          BE
              .
              .
  16          .          BF
              .           .
              .           .
  21          .           .          BG
              .           .           .
              .           .           .
  26          .           .           .      B12-1
              .           .           .          .
              .           .           .          .
  31          .           .           .          .       B12-2
              .           .           .          .           .
              .           .           .          .           .
  36          .           .           .        DP1............
              .           .           .          V
              .           .           .          V
  39          .           .           .        A-A
```



45
B12-3
50
B12-4
55
B12-7
60
DP2
63
B-B
69
B12-5
74
B12-8
79
DP3
82
C-C
88
B12-6
93
B12-9
98
DP4
101
D-D
107
B1210
112
DP5
115
E-E
121
B1211
126
DP6
129
F-F
135
B10111
140
B10112
145
DP8
148
G-G
154
300A
159
DP300
162
B9

```
 167        .        .        .        .      H-H
            .        .        .        .       .
            .        .        .        .       .
 173        .        .        .        .       .        300B
            .        .        .        .       .          .
            .        .        .        .       .          .
 178        .        .        .        .      DP9............
            .        .        .        .       .
            .        .        .        .       .
 181        .        .        .     DP301...........
            .        .        .        V
            .        .        .        V
 184        .        .        .       I-I
            .        .        .        .
            .        .        .        .
 190        .        .        .        .      300C
            .        .        .        .        .
            .        .        .        .        .
 195        .        .        .     DP302...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1****************************************                    ****************************************
*                                       *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*           SEPTEMBER 1990              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.0                *                    *        609 SECOND STREET             *
*                                       *                    *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  02/24/1998  TIME  09:41:35 *                    *         (916) 756-1104               *
*                                       *                    *                                      *
*****************************************                    ****************************************
```

```
                    BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
                     100YR,2HR      EXISTING          PART 2
                    FULL BASIN RUNOFF STUDY         100BX2.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

   6 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           1  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1DEC97  STARTING DATE
                      ITIME        1200  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1DEC97  ENDING DATE
                     NDTIME        1659  ENDING TIME
                      ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .02 HOURS
                     TOTAL TIME BASE    4.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BE	3.	.75	1.	1.	1.	.01		
+	HYDROGRAPH AT	BF	3.	.73	1.	1.	1.	.01		

+	HYDROGRAPH AT	BG	8.	.83	2.	2.	2.	.03		
+	HYDROGRAPH AT	B12-1	112.	.65	14.	14.	14.	.09		
+	HYDROGRAPH AT	B12-2	37.	.63	4.	4.	4.	.03		
+	2 COMBINED AT	DP1	148.	.65	18.	18.	18.	.12		
+	ROUTED TO	A-A	148.	.67	18.	18.	18.	.12		
+									1.51	.67
+	HYDROGRAPH AT	B12-3	32.	.68	4.	4.	4.	.03		
+	HYDROGRAPH AT	B12-4	47.	.63	6.	6.	6.	.04		
+	HYDROGRAPH AT	B12-7	18.	.67	2.	2.	2.	.02		
+	4 COMBINED AT	DP2	244.	.67	30.	30.	30.	.20		
+	ROUTED TO	B-B	242.	.68	30.	30.	30.	.20		
+									2.15	.68
+	HYDROGRAPH AT	B12-5	102.	.68	13.	13.	13.	.08		
+	HYDROGRAPH AT	B12-8	31.	.60	3.	3.	3.	.02		
+	3 COMBINED AT	DP3	369.	.67	47.	47.	47.	.30		
+	ROUTED TO	C-C	369.	.68	47.	47.	47.	.30		
+									2.52	.68
+	HYDROGRAPH AT	B12-6	82.	.65	10.	10.	10.	.06		
+	HYDROGRAPH AT	B12-9	25.	.65	3.	3.	3.	.02		
+	3 COMBINED AT	DP4	472.	.68	60.	60.	60.	.38		
+	ROUTED TO	D-D	466.	.70	60.	60.	60.	.38		
+									3.16	.70
+	HYDROGRAPH AT	B1210	72.	.72	10.	10.	10.	.07		
+	2 COMBINED AT	DP5	537.	.70	71.	71.	71.	.45		
+	ROUTED TO	E-E	527.	.73	71.	71.	71.	.45		
+									3.93	.73
+	HYDROGRAPH AT	B1211	57.	.58	6.	6.	6.	.04		
+	2 COMBINED AT	DP6	564.	.73	77.	77.	77.	.49		
+	ROUTED TO	F-F	558.	.75	77.	77.	77.	.49		
+									3.87	.75
	HYDROGRAPH AT									

+		B10111	37.	.70	5.	5.	5.	.04		
+	HYDROGRAPH AT	B10112	39.	.70	5.	5.	5.	.04		
+	3 COMBINED AT	DP8	630.	.75	87.	87.	87.	.57		
+	ROUTED TO	G-G	624.	.77	87.	87.	87.	.57		
+									4.19	.77
+	HYDROGRAPH AT	300A	11.	1.02	3.	3.	3.	.05		
+	2 COMBINED AT	DP300	632.	.77	90.	90.	90.	.62		
+	HYDROGRAPH AT	B9	91.	.67	12.	12.	12.	.09		
+	ROUTED TO	H-H	89.	.68	12.	12.	12.	.09		
+									1.07	.68
+	HYDROGRAPH AT	300B	6.	.92	1.	1.	1.	.03		
+	2 COMBINED AT	DP9	93.	.70	13.	13.	13.	.11		
+	2 COMBINED AT	DP301	718.	.77	103.	103.	103.	.73		
+	ROUTED TO	I-I	710.	.78	103.	103.	103.	.73		
+									4.31	.78
+	HYDROGRAPH AT	300C	14.	.98	3.	3.	3.	.06		
+	2 COMBINED AT	DP302	721.	.78	106.	106.	106.	.79		

*** NORMAL END OF HEC-1 ***

```
1***************************************                                       ***************************************
 *                                     *                                       *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *    U.S. ARMY CORPS OF ENGINEERS     *
 *            SEPTEMBER 1990           *                                       *    HYDROLOGIC ENGINEERING CENTER    *
 *             VERSION 4.0             *                                       *          609 SECOND STREET          *
 *                                     *                                       *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE  02/24/1998  TIME  09:38:40 *                                     *           (916) 756-1104            *
 *                                     *                                       *                                     *
***************************************                                       ***************************************


                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX


         THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

         THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
         THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
         NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
         DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
         KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                  HEC-1 INPUT                                               PAGE  1

         LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1        ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
           2        ID        5-YR,2-HR       DEVELOPED        PART 1
           3        ID        FULL BASIN RUNOFF STUDY        5BD1.DAT
                    *DIAGRAM
           4        IT       1 01DEC97    1200    1500
           5        IN       5
           6        IO       5       0

           7        KK     B34
           8        KM        RUNOFF FROM SDA       34
           9        BA    .023
          10        PB     1.6
          11        PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
          12        PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
          13        PI     .01     .01     .01     .01
          14        LS       0      74       7
          15        UD    .125

          16        KK     J-J
          17        KM        ROUTE FLOW FROM B3 THRU 500C
          18        RS       1    STOR       0
          19        RC    0.12     .08    0.12    1500     .21
          20        RX       0       5      10      20      28      38      43      48
          21        RY      15    12.5      10       0       0      10    12.5      15

          22        KK    500C
          23        KM         RUNOFF FROM 500C
          24        BA    .015
          25        LS       0      72       4
          26        UD    .108

          27        KK   DP345
          28        KM        COMBINE SDAs 34 & 500C
          29        HC       2

          30        KK      B5
          31        KM        RUNOFF FROM SDA 5
          32        BA    .042
          33        LS       0      74       7
          34        UD    .131
```

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  35          KK      B6
  36          KM        RUNOFF FROM SDA 6
  37          BA    .022
  38          LS       0       74        7
  39          UD    .131

  40          KK    DP56
  41          KM        COMBINE FLOWS FROM SDAs 5&6
  42          HC       2
1                                   HEC-1 INPUT                                            PAGE  2

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  43          KK     K-K
  44          KM        ROUTE FLOW FROM DP 56 THRU 500A
  45          RS       1    STOR        0
  46          RC    0.12      .08    0.12     2100      .22
  47          RX       0        5      10       20       28       38       43       48
  48          RY      15     12.5      10        0        0       10     12.5       15

  49          KK    500A
  50          KM        RUNOFF FROM SDA 500A
  51          BA    .036
  52          LS       0       72        4
  53          UD    .162

  54          KK   DP500
  55          KM        COMBINE FLOWS FROM CP56&500A
  56          HC       3

  57          KK    500B
  58          KM        RUNOFF FROM SDA 500B
  59          BA    .009
  60          LS       0       72        4
  61          UD    .108

  62          KK   DP501
  63          KM        COMBINE FLOWS FROM CP5A&500B
  64          HC       2

  65          KK      B7
  66          KM        RUNOFF FROM SDA 7
  67          BA    .014
  68          LS       0       74        7
  69          UD    .107

  70          KK    B8-1
  71          KM        RUNOFF FROM SDA 8-1
  72          BA    .056
  73          LS       0       74        7
  74          UD    .113

  75          KK    B8-2
  76          KM        RUNOFF FROM SDA 8-2
  77          BA    .016
  78          LS       0       74        7
  79          UD    .086

  80          KK     DP7
  81          KM        COMBINE FLOWS FROM SDAs 8-1, 8-2
  82          HC       2
1                                   HEC-1 INPUT                                            PAGE  3

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  83          KK    B8-3
  84          KM        RUNOFF FROM SDA 8-3
  85          BA    .021
  86          LS       0       74        7
  87          UD    .202

  88          KK    DP7A
  89          KM        COMBINE FLOW FROM CP7 & SDA 8-3 &B7
  90          HC       3

  91          KK    400A
  92          KM        RUNOFF FROM SDA     400A
  93          BA      .02
```

```
 94          LS       0      72       4
 95          UD    .210

 96          KK   DP401
 97          KM        COMBINE FLOWS FROM DP7A & SDA 400A
 98          HC       2

 99          KK    400B
100          KM        RUNOFF FROM SDA     400B
101          BA     .01
102          LS       0      72       4
103          UD    .210

104          KK   DP402
105          KM        COMBINE FLOWS FROM DP402& SDA 400B
106          HC       2

107          KK     B1A
108          KM        RUNOFF FROM BASIN 1A
109          BA   0.023
110          LS       0      78       5
111          UD    0.15

112          KK     B1B
113          KM        RUNOFF FROM BASIN 1B
114          BA   0.231
115          LS       0      78       5
116          UD    0.27

117          KK     B1C
118          KM        RUNOFF FROM BASIN 1C
119          BA   0.037
120          LS       0      78       5
121          UD    0.22

122          KK   DP1BC
123          KM        COMBINE FLOWS FROM BASIN 1B & 1C
124          HC       2
1                                      HEC-1 INPUT                                          PAGE  4

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


125          KK     A-A
126          KM        ROUTE FLOW FROM DP1BC THRU BASIN 1D
127          RS       1    STOR       0
128          RC    0.12    0.08    0.12    1600    0.21
129          RX       0       5      10      20      28      38      43      48
130          RY      15    12.5      10       0       0      10    12.5      15

131          KK     B1D
132          KM        RUNOFF FROM BASIN 1D
133          BA   0.050
134          LS       0      78       5
135          UD    0.04

136          KK DP1ABCD
137          KM        COMBINE FLOWS FROM BASINS 1A THRU 1D
138          HC       2

139          KK     C-C
140          KM        ROUTE FLOW FROM BASINS 1A-1D THRU BASIN A
141          RS       1    STOR       0
142          RC    0.12    0.08    0.12    4000     .08
143          RX       0       5      10      20      28      38      43      48
144          RY      15    12.5      10       0       0      10    12.5      15

145          KK      BA
146          KM        RUNOFF FROM BASIN A
147          BA    0.09
148          LS       0      72       5
149          UD    0.23

150          KK     DP1
151          KM        COMBINE FLOWS FROM BASINS 1A-1D & BASIN A
152          HC       2

153          KK      B2
154          KM        RUNOFF FROM BASIN 2
155          BA   0.043
```

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156      LS      0      78      5
157      UD   0.19

158      KK    D-D
159      KM       ROUTE FLOW FROM BASIN 2 THRU BASIN C
160      RS      1    STOR      0
161      RC   0.12    0.08   0.12    6400    0.07
162      RX      0       5     10      20      28      38      43      48
163      RY     15    12.5     10       0       0      10    12.5      15

164      KK    B2X
165      KM       RUNOFF FROM BASIN 2X
166      BA   .005
167      LS      0      78      5
168      UD   0.13
```



```
LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

169      KK    X-X
170      KM       ROUTE FLOW FROM BASIN 2X THRU BASIN C
171      RS      1    STOR      0
172      RC   0.12    0.08   0.12      50    0.49
173      RX      0       5     10      20      28      38      43      48
174      RY     15    12.5     10       0       0      10    12.5      15

175      KK     BC
176      KM       RUNOFF FROM BASIN C
177      BA   0.09
178      LS      0      72      5
179      UD   0.17

180      KK    DP2
181      KM       COMBINE FLOWS FROM BASINS 2, 2X & C
182      HC      3

183      KK     B3
184      KM       RUNOFF FROM BASIN 3
185      BA 0.0687
186      LS      0      78      5
187      UD   0.26

188      KK    E-E
189      KM       ROUTE FLOW FROM BASIN 3 THRU BASIN H
190      RS      1    STOR      0
191      RC   0.12    0.08   0.12    7200    0.03
192      RX      0       5     10      20      28      38      43      48
193      RY     15    12.5     10       0       0      10    12.5      15

194      KK     B4
195      KM       RUNOFF FROM BASIN 4
196      BA  0.096
197      LS      0      78      5
198      UD   0.21

199      KK    F-F
200      KM       ROUTE FLOW FROM BASIN 4 THRU BASIN H
201      RS      1    STOR      0
202      RC   0.12    0.08   0.12    2800    0.05
203      RX      0       5     10      20      28      38      43      48
204      RY     15    12.5     10       0       0      10    12.5      15

205      KK     BH
206      KM       RUNOFF FROM BASIN H
207      BA   0.03
208      LS      0      72      5
209      UD   0.17
```



```
LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

210      KK    DP3
211      KM       COMBINE FLOWS FROM BASINS 3, 4 & H
212      HC      3

213      KK     BB
214      KM       RUNOFF FROM BASIN B
215      BA   0.02
```

```
         216          LS       0      72       5
         217          UD    0.14

         218          KK      BD
         219          KM         RUNOFF FROM BASIN D
         220          BA    0.02
         221          LS       0      72       5
         222          UD    0.16
         223          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7          B34
                V
                V
  16          J-J
                .
                .
  22            .          500C
                .             .
                .             .
  27        DP345.............
                .
                .
  30            .            B5
                .             .
                .             .
  35            .             .          B6
                .             .           .
                .             .           .
  40            .          DP56............
                .             V
                .             V
  43            .           K-K
                .             .
                .             .
  49            .             .        500A
                .             .           .
                .             .           .
  54         DP500.......................
                .
                .
  57            .          500B
                .             .
                .             .
  62         DP501............
                .
                .
  65            .            B7
                .             .
                .             .
  70            .             .        B8-1
                .             .           .
                .             .           .
  75            .             .           .          B8-2
                .             .           .             .
                .             .           .             .
  80            .             .         DP7............
                .             .           .
                .             .           .
  83            .             .           .          B8-3
                .             .           .             .
                .             .           .             .
  88            .          DP7A.......................
                .             .
                .             .
  91            .             .        400A
                .             .           .
                .             .           .
  96            .         DP401............
                .             .
                .             .
  99            .             .        400B
                .             .           .
                .             .           .
 104            .         DP402............
```

```
               .           .
               .           .
107            .           .         B1A
               .           .           .
               .           .           .
112            .           .           .         B1B
               .           .           .           .
               .           .           .           .
117            .           .           .           .         B1C
               .           .           .           .           .
               .           .           .           .           .
122            .           .           .       DP1BC............
               .           .           .           V
               .           .           .           V
125            .           .           .         A-A
               .           .           .           .
               .           .           .           .
131            .           .           .           .         B1D
               .           .           .           .           .
               .           .           .           .           .
136            .           .           .      DP1ABC............
               .           .           .           V
               .           .           .           V
139            .           .           .         C-C
               .           .           .           .
               .           .           .           .
145            .           .           .           .          BA
               .           .           .           .           .
               .           .           .           .           .
150            .           .           .         DP1............
               .           .           .           .
               .           .           .           .
153            .           .           .           .          B2
               .           .           .           .           V
               .           .           .           .           V
158            .           .           .           .         D-D
               .           .           .           .           .
               .           .           .           .           .
164            .           .           .           .           .         B2X
               .           .           .           .           .           V
               .           .           .           .           .           V
169            .           .           .           .           .         X-X
               .           .           .           .           .           .
               .           .           .           .           .           .
175            .           .           .           .           .           .          BC
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
180            .           .           .           .         DP2........................
               .           .           .           .           .
               .           .           .           .           .
183            .           .           .           .           .          B3
               .           .           .           .           .           V
               .           .           .           .           .           V
188            .           .           .           .           .         E-E
               .           .           .           .           .           .
               .           .           .           .           .           .
194            .           .           .           .           .           .          B4
               .           .           .           .           .           .           V
               .           .           .           .           .           .           V
199            .           .           .           .           .           .         F-F
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
205            .           .           .           .           .           .           .          BH
               .           .           .           .           .           .           .           .
               .           .           .           .           .           .           .           .
210            .           .           .           .           .         DP3........................
               .           .           .           .           .           .
               .           .           .           .           .           .
213            .           .           .           .           .           .          BB
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
218            .           .           .           .           .           .           .          BD
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************                                        ****************************************
*                                        *                                        *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                        *   U.S. ARMY CORPS OF ENGINEERS       *
*           SEPTEMBER 1990               *                                        *   HYDROLOGIC ENGINEERING CENTER      *
*             VERSION 4.0                *                                        *        609 SECOND STREET             *
*                                        *                                        *     DAVIS, CALIFORNIA 95616          *
```

BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
5-YR,2-HR   DEVELOPED   PART 1
FULL BASIN RUNOFF STUDY   5BD1.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

```
  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          1  MINUTES IN COMPUTATION INTERVAL
                    IDATE    1DEC97  STARTING DATE
                    ITIME      1200  STARTING TIME
                       NQ       300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE    1DEC97  ENDING DATE
                   NDTIME      1659  ENDING TIME
                    ICENT        19  CENTURY MARK

              COMPUTATION INTERVAL     .02 HOURS
                   TOTAL TIME BASE    4.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA            SQUARE MILES
            PRECIPITATION DEPTH      INCHES
            LENGTH, ELEVATION        FEET
            FLOW                     CUBIC FEET PER SECOND
            STORAGE VOLUME           ACRE-FEET
            SURFACE AREA             ACRES
            TEMPERATURE              DEGREES FAHRENHEIT
```

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+										
+	HYDROGRAPH AT	B34	5.	.70	1.	1.	1.	.02		
+	ROUTED TO	J-J	5.	.77	1.	1.	1.	.02		
+									.08	.77
+	HYDROGRAPH AT	500C	2.	.73	0.	0.	0.	.01		
+	2 COMBINED AT	DP345	7.	.77	1.	1.	1.	.04		
+	HYDROGRAPH AT	B5	9.	.72	2.	2.	2.	.04		
+	HYDROGRAPH AT	B6	5.	.72	1.	1.	1.	.02		
+	2 COMBINED AT	DP56	13.	.72	2.	2.	2.	.06		
+	ROUTED TO	K-K	12.	.80	2.	2.	2.	.06		
+									.20	.80
+	HYDROGRAPH AT	500A	5.	.82	1.	1.	1.	.04		
+	3 COMBINED AT	DP500	23.	.80	5.	5.	5.	.14		

+	HYDROGRAPH AT	500B	1.	.73	0.	0.	0.	.01		
+	2 COMBINED AT	DP501	24.	.78	5.	5.	5.	.15		
+	HYDROGRAPH AT	B7	3.	.68	1.	1.	1.	.01		
+	HYDROGRAPH AT	B8-1	12.	.68	2.	2.	2.	.06		
+	HYDROGRAPH AT	B8-2	4.	.65	1.	1.	1.	.02		
+	2 COMBINED AT	DP7	15.	.68	3.	3.	3.	.07		
+	HYDROGRAPH AT	B8-3	4.	.80	1.	1.	1.	.02		
+	3 COMBINED AT	DP7A	22.	.70	4.	4.	4.	.11		
+	HYDROGRAPH AT	400A	2.	.88	1.	1.	1.	.02		
+	2 COMBINED AT	DP401	24.	.70	4.	4.	4.	.13		
+	HYDROGRAPH AT	400B	1.	.88	0.	0.	0.	.01		
+	2 COMBINED AT	DP402	24.	.72	5.	5.	5.	.14		
+	HYDROGRAPH AT	B1A	6.	.73	1.	1.	1.	.02		
+	HYDROGRAPH AT	B1B	52.	.90	10.	10.	10.	.23		
+	HYDROGRAPH AT	B1C	9.	.83	2.	2.	2.	.04		
+	2 COMBINED AT	DP1BC	61.	.88	12.	12.	12.	.27		
+	ROUTED TO	A-A	60.	.93	12.	12.	12.	.27		
+									.90	.93
+	HYDROGRAPH AT	B1D	18.	.60	2.	2.	2.	.05		
+	2 COMBINED AT	DP1ABC	68.	.93	14.	14.	14.	.32		
+	ROUTED TO	C-C	60.	1.12	14.	14.	14.	.32		
+									1.19	1.12
+	HYDROGRAPH AT	BA	11.	.88	3.	3.	3.	.09		
+	2 COMBINED AT	DP1	70.	1.10	17.	17.	17.	.41		
+	HYDROGRAPH AT	B2	11.	.78	2.	2.	2.	.04		
+	ROUTED TO	D-D	7.	1.23	2.	2.	2.	.04		
+									.19	1.23
+	HYDROGRAPH AT	B2X	1.	.70	0.	0.	0.	.00		
+	ROUTED TO	X-X	1.	.70	0.	0.	0.	.00		

+									.02	.70
+	HYDROGRAPH AT	BC	12.	.80	3.	3.	3.	.09		
+	3 COMBINED AT	DP2	18.	.88	5.	5.	5.	.14		
+	HYDROGRAPH AT	B3	16.	.88	3.	3.	3.	.07		
+	ROUTED TO	E-E	8.	1.47	3.	3.	3.	.07		
+									.36	1.47
+	HYDROGRAPH AT	B4	24.	.82	4.	4.	4.	.10		
+	ROUTED TO	F-F	18.	1.07	4.	4.	4.	.10		
+									.64	1.07
+	HYDROGRAPH AT	BH	4.	.80	1.	1.	1.	.03		
+	3 COMBINED AT	DP3	28.	1.15	8.	8.	8.	.19		
+	HYDROGRAPH AT	BB	3.	.77	1.	1.	1.	.02		
+	HYDROGRAPH AT	BD	3.	.78	1.	1.	1.	.02		

*** NORMAL END OF HEC-1 ***

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1****************************************                         ****************************************
 *                                      *                         *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                         *    U.S. ARMY CORPS OF ENGINEERS      *
 *            SEPTEMBER 1990            *                         *    HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0              *                         *          609 SECOND STREET           *
 *                                      *                         *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE  02/24/1998  TIME  09:38:59 *                        *            (916) 756-1104            *
 *                                      *                         *                                      *
****************************************                          ****************************************


                                       X       X  XXXXXXX   XXXXX          X
                                       X       X  X        X     X        XX
                                       X       X  X        X               X
                                       XXXXXXX  XXXX       X       XXXXX   X
                                       X       X  X        X               X
                                       X       X  X        X     X         X
                                       X       X  XXXXXXX   XXXXX         XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                    HEC-1 INPUT                                                 PAGE  1

         LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1            ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
            2            ID        5-YR,2-HR        DEVELOPED         PART 2
            3            ID        FULL BASIN RUNOFF STUDY           5BD2.DAT
                         *DIAGRAM
            4            IT       1 01DEC97    1200     1500
            5            IN       5
            6            IO       5       0

            7            KK      BE
            8            KM        RUNOFF FROM BASIN E
            9            BA    0.01
           10            PB     1.6
           11            PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
           12            PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
           13            PI     .01     .01     .01     .01
           14            LS       0      72       5
           15            UD    0.14

           16            KK      BF
           17            KM        RUNOFF FROM BASIN F
           18            BA    0.13
           19            LS       0      72       5
           20            UD    0.13

           21            KK      BG
           22            KM        RUNOFF FROM BASIN G
           23            BA    0.03
           24            LS       0      72       5
           25            UD    0.19

           26            KK   B12-1
           27            KM        RUNOFF FROM SDA 12-1
           28            BA    .089
           29            LS       0      76       6
           30            UD    .126

           31            KK   B12-2
           32            KM        RUNOFF FROM SDA 12-2
           33            BA    .028
           34            LS       0      76       6
           35            UD    .113
```

```
  36          KK     DP1
  37          KM        COMBINE FLOWS FROM SDAs 12-1, 12-2
  38          HC       2

  39          KK     A-A
  40          KM        ROUTE FLOWS FROM CP1 TO CP2
  41          RS       1    STOR       0
  42          RC    0.12     .08    0.12     630    0.24
  43          RX       0       5      10      20      28      38      43      48
  44          RY      15    12.5      10       0       0      10    12.5      15
1                                          HEC-1 INPUT                                        PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  45          KK   B12-3
  46          KM        RUNOFF FROM SDA 12-3
  47          BA    .027
  48          LS       0      76       6
  49          UD    .145

  50          KK   B12-4
  51          KM        RUNOFF FROM SDA 12-4
  52          BA    .038
  53          LS       0      75       6
  54          UD    .110

  55          KK   B12-7
  56          KM        RUNOFF FROM SDA 12-7
  57          BA    .016
  58          LS       0      75       5
  59          UD    .134

  60          KK     DP2
  61          KM        COMBINE CP1 & SDAs 12-3, 12-4, 12-7
  62          HC       4

  63          KK     B-B
  64          KM        ROUTE FLOWS FROM CP2 TO CP3
  65          RS       1    STOR       0
  66          RC    0.12     .08    0.12     790    0.19
  67          RX       0       5      10      20      28      38      43      48
  68          RY      15    12.5      10       0       0      10    12.5      15

  69          KK   B12-5
  70          KM        RUNOFF FROM SDA 12-5
  71          BA    .081
  72          LS       0      76      10
  73          UD    .154

  74          KK   B12-8
  75          KM        RUNOFF FROM SDA 12-8
  76          BA    .023
  77          LS       0      75       5
  78          UD    .077

  79          KK     DP3
  80          KM        COMBINE FLOWS FROM CP2 & SDAs 12-5, 12-8
  81          HC       3

  82          KK     C-C
  83          KM        ROUTE FLOW FROM CP3 TO CP4
  84          RS       1    STOR       0
  85          RC    0.12     .08    0.12     650    0.26
  86          RX       0       5      10      20      28      38      43      48
  87          RY      15    12.5      10       0       0      10    12.5      15
1                                          HEC-1 INPUT                                        PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  88          KK   B12-6
  89          KM        RUNOFF FROM SDA 12-6
  90          BA    .061
  91          LS       0      76      10
  92          UD    .129

  93          KK   B12-9
  94          KM        RUNOFF FROM SDA 12-9
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```
  95        BA   .021
  96        LS     0      75      4
  97        UD   .112

  98        KK    DP4
  99        KM       COMBINE FLOWS FROM CP3 & SDAs 12-6, 12-9
 100        HC     3

 101        KK    D-D
 102        KM       ROUTE FLOWS FROM CP4 TO CP5
 103        RS     1    STOR      0
 104        RC  0.12     .08    0.12    1420    0.19
 105        RX     0       5      10      20      28      38      43      48
 106        RY    15    12.5      10       0       0      10    12.5      15

 107        KK  B1210
 108        KM       RUNOFF FROM SDA 12-10
 109        BA   .069
 110        LS     0      75       5
 111        UD   .170

 112        KK    DP5
 113        KM       COMBINE FLOWS FROM CP4 & SDA 1210
 114        HC     2

 115        KK    E-E
 116        KM       ROUTE FLOW FROM CP5 TO CP6
 117        RS     1    STOR      0
 118        RC  0.12     .08    0.12    1420    0.11
 119        RX     0       5      10      20      28      38      43      48
 120        RY    15    12.5      10       0       0      10    12.5      15

 121        KK    DAM
 122        KM       ROUTE FLOW THROUGH FISHERS CNAYON DEBRIS CONTROL STURCTURE
 123        RS     1    ELEV    7155
 124        SV     0     0.3    0.75    1.35    2.55     3.6     3.8     6.1     8.5    11.0
 125        SV  13.5    16.1    18.8
 126        SE  7155    7160    7165    7170    7175    7178    7180    7182    7184    7186
 127        SE  7188    7190    7192
 128        SQ     0      19      39      51      61      67      70     158     197     227
 129        SQ  1853    4801    8610
1                                      HEC-1 INPUT                                       PAGE  4

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 130        KK  B1211
 131        KM       RUNOFF FROM SDA 12-11
 132        BA   .041
 133        LS     0      74      10
 134        UD   .073

 135        KK    DP6
 136        KM       COMBINE DP5 & 1211
 137        HC     2

 138        KK    F-F
 139        KM       ROUTE FLOW FROM 12-11 TO 1011-1
 140        RS     1    STOR      0
 141        RC  0.12     .08    0.12    1200     .13
 142        RX     0       5      10      20      28      38      43      48
 143        RY    15    12.5      10       0       0      10    12.5      15

 144        KK B10111
 145        KM       RUNOFF FROM SDA 1011-1
 146        BA   .035
 147        LS     0      74       7
 148        UD   .160

 149        KK B10112
 150        KM       RUNOFF FROM SDA 1011-2
 151        BA   .037
 152        LS     0      74       7
 153        UD   .160

 154        KK    DP8
 155        KM       COMBINE FLOW FROM SDA 1012 & CP6A
 156        HC     3

 157        KK    G-G
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   158          KM        ROUTE FLOW FROM DP8 TO DP300
   159          RS      1    STOR      0
   160          RC   0.12     .08   0.12   1200     .12
   161          RX      0       5     10     20      28      38      43      48
   162          RY     15    12.5     10      0       0      10    12.5      15

   163          KK    300A
   164          KM        RUNOFF FROM 300A
   165          BA   .049
   166          LS      0      65      4
   167          UD   .162

   168          KK   DP300
   169          KM        COMBINE FLOWS FROM CP8 & SDA 300A
   170          HC      2
1                                    HEC-1 INPUT                                            PAGE  5

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   171          KK     B9
   172          KM        RUNOFF FROM SDA 9
   173          BA   .085
   174          LS      0      74      4
   175          UD   .125

   176          KK    H-H
   177          KM        ROUTE FLOW FROM B9 THRU SDA 300B
   178          RS      1    STOR      0
   179          RC   0.12     .08   0.12   1200     .25
   180          RX      0       5     10     20      28      38      43      48
   181          RY     15    12.5     10      0       0      10    12.5      15

   182          KK    300B
   183          KM        RUNOFF FROM 300B
   184          BA   .026
   185          LS      0      68      4
   186          UD   .126

   187          KK    DP9
   188          KM        COMBINE SDA B9 & 300B
   189          HC      2

   190          KK   DP301
   191          KM        COMBINE FLOWS FROM CP300 & SDA 300B
   192          HC      2

   193          KK    I-I
   194          KM        ROUTE FLOW FROM B9 THRU SDA 300B
   195          RS      1    STOR      0
   196          RC   0.12     .08   0.12   1800     .17
   197          RX      0       4    5.5    6.5    14.5    15.5      17      21
   198          RY      7       5      2      0       0       2       5       7

   199          KK    300C
   200          KM        RUNOFF FROM SDA 300C
   201          BA    .06
   202          LS      0      72      4
   203          UD   .150

   204          KK   DP302
   205          KM        COMBINE FLOWS FROM CP301 & 300C
   206          HC      2
   207          ZZ
1
        SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

   NO.     (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7         BE
              .
              .
   16         .         BF
              .          .
              .          .
   21         .          .          BG
              .          .           .
              .          .           .
```

```
26    .    .    .     B12-1
      .    .    .         .
      .    .    .         .
31    .    .    .         .         B12-2
      .    .    .         .             .
      .    .    .         .             .
36    .    .    .       DP1..............
      .    .    .         V
      .    .    .         V
39    .    .    .       A-A
      .    .    .         .
      .    .    .         .
45    .    .    .         .         B12-3
      .    .    .         .             .
      .    .    .         .             .
50    .    .    .         .             .       B12-4
      .    .    .         .             .           .
      .    .    .         .             .           .
55    .    .    .         .             .           .       B12-7
      .    .    .         .             .           .           .
      .    .    .         .             .           .           .
60    .    .    .       DP2......................................
      .    .    .         V
      .    .    .         V
63    .    .    .       B-B
      .    .    .         .
      .    .    .         .
69    .    .    .         .         B12-5
      .    .    .         .             .
      .    .    .         .             .
74    .    .    .         .             .       B12-8
      .    .    .         .             .           .
      .    .    .         .             .           .
79    .    .    .       DP3..........................
      .    .    .         V
      .    .    .         V
82    .    .    .       C-C
      .    .    .         .
      .    .    .         .
88    .    .    .         .         B12-6
      .    .    .         .             .
      .    .    .         .             .
93    .    .    .         .             .       B12-9
      .    .    .         .             .           .
      .    .    .         .             .           .
98    .    .    .       DP4..........................
      .    .    .         V
      .    .    .         V
101   .    .    .       D-D
      .    .    .         .
      .    .    .         .
107   .    .    .         .         B1210
      .    .    .         .             .
      .    .    .         .             .
112   .    .    .       DP5..............
      .    .    .         V
      .    .    .         V
115   .    .    .       E-E
      .    .    .         V
      .    .    .         V
121   .    .    .       DAM
      .    .    .         .
      .    .    .         .
130   .    .    .         .         B1211
      .    .    .         .             .
      .    .    .         .             .
135   .    .    .       DP6..............
      .    .    .         V
      .    .    .         V
138   .    .    .       F-F
      .    .    .         .
      .    .    .         .
144   .    .    .         .        B10111
      .    .    .         .             .
      .    .    .         .             .
149   .    .    .         .             .      B10112
      .    .    .         .             .           .
      .    .    .         .             .           .
154   .    .    .       DP8..........................
      .    .    .         V
```

```
                                                  V
157        .          .          .              G-G
           .          .          .                .
163        .          .          .                .        300A
           .          .          .                .           .
           .          .          .                .           .
168        .          .          .            DP300............
           .          .          .                .
           .          .          .                .
171        .          .          .                .          B9
           .          .          .                .           V
           .          .          .                .           V
176        .          .          .                .         H-H
           .          .          .                .           .
           .          .          .                .           .
182        .          .          .                .           .          300B
           .          .          .                .           .             .
           .          .          .                .           .             .
187        .          .          .                .         DP9............
           .          .          .                .           .
           .          .          .                .           .
190        .          .          .            DP301............
           .          .          .                V
           .          .          .                V
193        .          .          .              I-I
           .          .          .                .
           .          .          .                .
199        .          .          .                .        300C
           .          .          .                .           .
           .          .          .                .           .
204        .          .          .            DP302............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1****************************************                                 ***************************************
*                                       *                                 *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                 *   U.S. ARMY CORPS OF ENGINEERS      *
*            SEPTEMBER 1990             *                                 *   HYDROLOGIC ENGINEERING CENTER     *
*             VERSION 4.0               *                                 *        609 SECOND STREET            *
*                                       *                                 *     DAVIS, CALIFORNIA 95616         *
*  RUN DATE  02/24/1998  TIME  09:38:59 *                                 *         (916) 756-1104              *
*                                       *                                 *                                     *
*****************************************                                 ***************************************
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                              BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
                              5-YR,2-HR       DEVELOPED         PART 2
                              FULL BASIN RUNOFF STUDY         5BD2.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

   6 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          1  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1DEC97  STARTING DATE
                       ITIME       1200  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     1DEC97  ENDING DATE
                      NDTIME       1659  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .02 HOURS
                      TOTAL TIME BASE    4.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT	BE	1.	.75	0.	0.	0.	.01		
+	HYDROGRAPH AT	BF	18.	.75	4.	4.	4.	.13		
+	HYDROGRAPH AT	BG	4.	.83	1.	1.	1.	.03		
+	HYDROGRAPH AT	B12-1	22.	.70	4.	4.	4.	.09		
+	HYDROGRAPH AT	B12-2	7.	.68	1.	1.	1.	.03		
+	2 COMBINED AT	DP1	29.	.70	5.	5.	5.	.12		
+ +	ROUTED TO	A-A	28.	.73	5.	5.	5.	.12	.46	.73
+	HYDROGRAPH AT	B12-3	6.	.73	1.	1.	1.	.03		
+	HYDROGRAPH AT	B12-4	9.	.68	1.	1.	1.	.04		
+	HYDROGRAPH AT	B12-7	3.	.73	1.	1.	1.	.02		
+	4 COMBINED AT	DP2	46.	.72	8.	8.	8.	.20		
+ +	ROUTED TO	B-B	46.	.75	8.	8.	8.	.20	.81	.75
+	HYDROGRAPH AT	B12-5	23.	.72	4.	4.	4.	.08		
+	HYDROGRAPH AT	B12-8	5.	.65	1.	1.	1.	.02		
+	3 COMBINED AT	DP3	73.	.73	12.	12.	12.	.30		
+ +	ROUTED TO	C-C	73.	.75	12.	12.	12.	.30	.94	.75
+	HYDROGRAPH AT	B12-6	18.	.68	3.	3.	3.	.06		
+	HYDROGRAPH AT	B12-9	4.	.72	1.	1.	1.	.02		
+	3 COMBINED AT	DP4	94.	.75	16.	16.	16.	.38		
+ +	ROUTED TO	D-D	92.	.78	16.	16.	16.	.38	1.19	.78
+	HYDROGRAPH AT	B1210	13.	.78	2.	2.	2.	.07		
+	2 COMBINED AT	DP5	105.	.78	18.	18.	18.	.45		
+	ROUTED TO	E-E	102.	.83	18.	18.	18.	.45		

+									1.53	.83
+	ROUTED TO	DAM	57.	1.32	18.	18.	18.	.45		
+									7172.93	1.32
+	HYDROGRAPH AT	B1211	11.	.62	2.	2.	2.	.04		
+	2 COMBINED AT	DP6	61.	1.13	20.	20.	20.	.49		
+	ROUTED TO	F-F	61.	1.17	20.	20.	20.	.49		
+									1.04	1.17
+	HYDROGRAPH AT	B10111	7.	.75	1.	1.	1.	.04		
+	HYDROGRAPH AT	B10112	7.	.75	1.	1.	1.	.04		
+	3 COMBINED AT	DP8	70.	1.13	23.	23.	23.	.57		
+	ROUTED TO	G-G	70.	1.17	23.	23.	23.	.57		
+									1.16	1.17
+	HYDROGRAPH AT	300A	3.	.63	1.	1.	1.	.05		
+	2 COMBINED AT	DP300	72.	1.17	23.	23.	23.	.62		
+	HYDROGRAPH AT	B9	15.	.73	3.	3.	3.	.09		
+	ROUTED TO	H-H	14.	.78	3.	3.	3.	.09		
+									.22	.78
+	HYDROGRAPH AT	300B	2.	.60	0.	0.	0.	.03		
+	2 COMBINED AT	DP9	16.	.80	3.	3.	3.	.11		
+	2 COMBINED AT	DP301	84.	1.15	27.	27.	27.	.73		
+	ROUTED TO	I-I	84.	1.17	27.	27.	27.	.73		
+									1.25	1.18
+	HYDROGRAPH AT	300C	8.	.80	2.	2.	2.	.06		
+	2 COMBINED AT	DP302	90.	1.15	28.	28.	28.	.79		

*** NORMAL END OF HEC-1 ***

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1*****************************************                        ***************************************
 *                                       *                        *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                        *   U.S. ARMY CORPS OF ENGINEERS      *
 *            SEPTEMBER 1990             *                        *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0               *                        *          609 SECOND STREET          *
 *                                       *                        *      DAVIS, CALIFORNIA 95616        *
 * RUN DATE  02/24/1998  TIME  09:40:11 *                         *           (916) 756-1104            *
 *                                       *                        *                                     *
*****************************************                         ***************************************


                    X     X  XXXXXXX   XXXXX           X
                    X     X  X        X     X         XX
                    X     X  X        X                X
                    XXXXXXX  XXXX     X        XXXXX   X
                    X     X  X        X                X
                    X     X  X        X     X          X
                    X     X  XXXXXXX   XXXXX          XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                        HEC-1 INPUT                                        PAGE  1

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1           ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
   2           ID         100YR,2HR      DEVELOPED         PART 1
   3           ID        FULL BASIN RUNOFF STUDY         100BD1.DAT
               *DIAGRAM
   4           IT        1 01DEC97     1200     1500
   5           IN        5
   6           IO        5       0

   7           KK      B34
   8           KM        RUNOFF FROM SDA        34
   9           BA     .023
  10           PB      3.1
  11           PI      .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
  12           PI      .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
  13           PI      .01     .01     .01     .01
  14           LS        0      74       7
  15           UD     .125

  16           KK      J-J
  17           KM        ROUTE FLOW FROM B3 THRU 500C
  18           RS        1    STOR       0
  19           RC     0.12     .08    0.12    1500     .21
  20           RX        0       5      10      20      28      38      43      48
  21           RY       15    12.5      10       0       0      10    12.5      15

  22           KK     500C
  23           KM         RUNOFF FROM 500C
  24           BA     .015
  25           LS        0      72       4
  26           UD     .108

  27           KK    DP345
  28           KM        COMBINE SDAs 34 & 500C
  29           HC        2

  30           KK       B5
  31           KM        RUNOFF FROM SDA 5
  32           BA     .042
  33           LS        0      74       7
  34           UD     .131
```

```
  35          KK      B6
  36          KM         RUNOFF FROM SDA 6
  37          BA     .022
  38          LS        0       74        7
  39          UD     .131

  40          KK     DP56
  41          KM         COMBINE FLOWS FROM SDAs 5&6
  42          HC        2
1                                        HEC-1 INPUT                                           PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  43          KK      K-K
  44          KM         ROUTE FLOW FROM DP 56 THRU 500A
  45          RS        1     STOR        0
  46          RC     0.12      .08     0.12     2100      .22
  47          RX        0        5       10       20       28       38       43       48
  48          RY       15     12.5       10        0        0       10     12.5       15

  49          KK     500A
  50          KM         RUNOFF FROM SDA 500A
  51          BA     .036
  52          LS        0       72        4
  53          UD     .162

  54          KK    DP500
  55          KM         COMBINE FLOWS FROM CP56&500A
  56          HC        3

  57          KK     500B
  58          KM         RUNOFF FROM SDA 500B
  59          BA     .009
  60          LS        0       72        4
  61          UD     .108

  62          KK    DP501
  63          KM         COMBINE FLOWS FROM CP5A&500B
  64          HC        2

  65          KK      B7
  66          KM         RUNOFF FROM SDA 7
  67          BA     .014
  68          LS        0       74        7
  69          UD     .107

  70          KK     B8-1
  71          KM         RUNOFF FROM SDA 8-1
  72          BA     .056
  73          LS        0       74        7
  74          UD     .113

  75          KK     B8-2
  76          KM         RUNOFF FROM SDA 8-2
  77          BA     .016
  78          LS        0       74        7
  79          UD     .086

  80          KK      DP7
  81          KM         COMBINE FLOWS FROM SDAs 8-1, 8-2
  82          HC        2
1                                        HEC-1 INPUT                                           PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  83          KK     B8-3
  84          KM         RUNOFF FROM SDA 8-3
  85          BA     .021
  86          LS        0       74        7
  87          UD     .202

  88          KK     DP7A
  89          KM         COMBINE FLOW FROM CP7 & SDA 8-3 &B7
  90          HC        3

  91          KK     400A
  92          KM         RUNOFF FROM SDA      400A
  93          BA      .02
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 94            LS      0       72        4
 95            UD    .210

 96            KK   DP401
 97            KM        COMBINE FLOWS FROM DP7A & SDA 400A
 98            HC       2

 99            KK    400B
100            KM        RUNOFF FROM SDA     400B
101            BA     .01
102            LS      0       72        4
103            UD    .210

104            KK   DP402
105            KM        COMBINE FLOWS FROM DP402& SDA 400B
106            HC       2

107            KK     B1A
108            KM        RUNOFF FROM BASIN 1A
109            BA   0.023
110            LS      0       78        5
111            UD    0.15

112            KK     B1B
113            KM        RUNOFF FROM BASIN 1B
114            BA   0.231
115            LS      0       78        5
116            UD    0.27

117            KK     B1C
118            KM        RUNOFF FROM BASIN 1C
119            BA   0.037
120            LS      0       78        5
121            UD    0.22

122            KK   DP1BC
123            KM        COMBINE FLOWS FROM BASIN 1B & 1C
124            HC       2
```



```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


125            KK     A-A
126            KM        ROUTE FLOW FROM DP1BC THRU BASIN 1D
127            RS       1    STOR        0
128            RC    0.12    0.08     0.12     1600     0.21
129            RX       0       5       10       20       28       38       43       48
130            RY      15    12.5       10        0        0       10     12.5       15

131            KK     B1D
132            KM        RUNOFF FROM BASIN 1D
133            BA   0.050
134            LS      0       78        5
135            UD    0.04

136            KK DP1ABCD
137            KM        COMBINE FLOWS FROM BASINS 1A THRU 1D
138            HC       2

139            KK     C-C
140            KM        ROUTE FLOW FROM BASINS 1A-1D THRU BASIN A
141            RS       1    STOR        0
142            RC    0.12    0.08     0.12     4000      .08
143            RX       0       5       10       20       28       38       43       48
144            RY      15    12.5       10        0        0       10     12.5       15

145            KK      BA
146            KM        RUNOFF FROM BASIN A
147            BA    0.09
148            LS      0       72        5
149            UD    0.23

150            KK     DP1
151            KM        COMBINE FLOWS FROM BASINS 1A-1D & BASIN A
152            HC       2

153            KK      B2
154            KM        RUNOFF FROM BASIN 2
155            BA   0.043
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 156          LS      0      78       5
 157          UD   0.19

 158          KK    D-D
 159          KM       ROUTE FLOW FROM BASIN 2 THRU BASIN C
 160          RS      1    STOR       0
 161          RC   0.12    0.08    0.12    6400    0.07
 162          RX      0       5      10      20      28      38      43      48
 163          RY     15    12.5      10       0       0      10    12.5      15

 164          KK    B2X
 165          KM       RUNOFF FROM BASIN 2X
 166          BA   .005
 167          LS      0      78       5
 168          UD   0.13
1                                     HEC-1 INPUT                                         PAGE  5

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 169          KK    X-X
 170          KM       ROUTE FLOW FROM BASIN 2X THRU BASIN C
 171          RS      1    STOR       0
 172          RC   0.12    0.08    0.12      50    0.49
 173          RX      0       5      10      20      28      38      43      48
 174          RY     15    12.5      10       0       0      10    12.5      15

 175          KK     BC
 176          KM       RUNOFF FROM BASIN C
 177          BA   0.09
 178          LS      0      72       5
 179          UD   0.17

 180          KK    DP2
 181          KM       COMBINE FLOWS FROM BASINS 2, 2X & C
 182          HC      3

 183          KK     B3
 184          KM       RUNOFF FROM BASIN 3
 185          BA 0.0687
 186          LS      0      78       5
 187          UD   0.26

 188          KK    E-E
 189          KM       ROUTE FLOW FROM BASIN 3 THRU BASIN H
 190          RS      1    STOR       0
 191          RC   0.12    0.08    0.12    7200    0.03
 192          RX      0       5      10      20      28      38      43      48
 193          RY     15    12.5      10       0       0      10    12.5      15

 194          KK     B4
 195          KM       RUNOFF FROM BASIN 4
 196          BA  0.096
 197          LS      0      78       5
 198          UD   0.21

 199          KK    F-F
 200          KM       ROUTE FLOW FROM BASIN 4 THRU BASIN H
 201          RS      1    STOR       0
 202          RC   0.12    0.08    0.12    2800    0.05
 203          RX      0       5      10      20      28      38      43      48
 204          RY     15    12.5      10       0       0      10    12.5      15

 205          KK     BH
 206          KM       RUNOFF FROM BASIN H
 207          BA   0.03
 208          LS      0      72       5
 209          UD   0.17
1                                     HEC-1 INPUT                                         PAGE  6

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 210          KK    DP3
 211          KM       COMBINE FLOWS FROM BASINS 3, 4 & H
 212          HC      3

 213          KK     BB
 214          KM       RUNOFF FROM BASIN B
 215          BA   0.02
```

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           216          LS        0      72       5
           217          UD     0.14

           218          KK       BD
           219          KM          RUNOFF FROM BASIN D
           220          BA     0.02
           221          LS        0      72       5
           222          UD     0.16
           223          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

     7         B34
                 V
                 V
    16         J-J
                 .
                 .
    22           .        500C
                 .           .
                 .           .
    27       DP345............
                 .
                 .
    30           .          B5
                 .           .
                 .           .
    35           .           .          B6
                 .           .           .
                 .           .           .
    40           .        DP56............
                 .           V
                 .           V
    43           .         K-K
                 .           .
                 .           .
    49           .           .        500A
                 .           .           .
                 .           .           .
    54       DP500........................
                 .
                 .
    57           .        500B
                 .           .
                 .           .
    62       DP501............
                 .
                 .
    65           .          B7
                 .           .
                 .           .
    70           .           .        B8-1
                 .           .           .
                 .           .           .
    75           .           .           .        B8-2
                 .           .           .           .
                 .           .           .           .
    80           .           .         DP7............
                 .           .           .
                 .           .           .
    83           .           .           .        B8-3
                 .           .           .           .
                 .           .           .           .
    88           .        DP7A........................
                 .           .
                 .           .
    91           .           .        400A
                 .           .           .
                 .           .           .
    96           .       DP401............
                 .           .
                 .           .
    99           .           .        400B
                 .           .           .
                 .           .           .
   104           .       DP402............
```

```
               .           .
               .           .
107            .           .         B1A
               .           .           .
               .           .           .
112            .           .           .         B1B
               .           .           .           .
               .           .           .           .
117            .           .           .           .         B1C
               .           .           .           .           .
               .           .           .           .           .
122            .           .           .       DP1BC............
               .           .           .           V
               .           .           .           V
125            .           .           .         A-A
               .           .           .           .
               .           .           .           .
131            .           .           .           .         B1D
               .           .           .           .           .
               .           .           .           .           .
136            .           .           .      DP1ABC............
               .           .           .           V
               .           .           .           V
139            .           .           .         C-C
               .           .           .           .
               .           .           .           .
145            .           .           .           .          BA
               .           .           .           .           .
               .           .           .           .           .
150            .           .           .         DP1............
               .           .           .           .
               .           .           .           .
153            .           .           .           .          B2
               .           .           .           .           V
               .           .           .           .           V
158            .           .           .           .         D-D
               .           .           .           .           .
               .           .           .           .           .
164            .           .           .           .           .         B2X
               .           .           .           .           .           V
               .           .           .           .           .           V
169            .           .           .           .           .         X-X
               .           .           .           .           .           .
               .           .           .           .           .           .
175            .           .           .           .           .           .          BC
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
180            .           .           .           .         DP2........................
               .           .           .           .           .
               .           .           .           .           .
183            .           .           .           .           .          B3
               .           .           .           .           .           V
               .           .           .           .           .           V
188            .           .           .           .           .         E-E
               .           .           .           .           .           .
               .           .           .           .           .           .
194            .           .           .           .           .           .          B4
               .           .           .           .           .           .           V
               .           .           .           .           .           .           V
199            .           .           .           .           .           .         F-F
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
205            .           .           .           .           .           .           .          BH
               .           .           .           .           .           .           .           .
               .           .           .           .           .           .           .           .
210            .           .           .           .           .         DP3........................
               .           .           .           .           .           .
               .           .           .           .           .           .
213            .           .           .           .           .           .          BB
               .           .           .           .           .           .           .
               .           .           .           .           .           .           .
218            .           .           .           .           .           .           .          BD

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************                                         ****************************************
 *                                       *                                         *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                         *    U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990              *                                         *    HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0               *                                         *          609 SECOND STREET           *
 *                                       *                                         *       DAVIS, CALIFORNIA 95616        *
```

BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
100YR,2HR DEVELOPED PART 1
FULL BASIN RUNOFF STUDY 100BD1.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

```
  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          1  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1DEC97  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1DEC97  ENDING DATE
                   NDTIME       1659  ENDING TIME
                    ICENT         19  CENTURY MARK

               COMPUTATION INTERVAL     .02 HOURS
                    TOTAL TIME BASE    4.98 HOURS

          ENGLISH UNITS
               DRAINAGE AREA            SQUARE MILES
               PRECIPITATION DEPTH      INCHES
               LENGTH, ELEVATION        FEET
               FLOW                     CUBIC FEET PER SECOND
               STORAGE VOLUME           ACRE-FEET
               SURFACE AREA             ACRES
               TEMPERATURE              DEGREES FAHRENHEIT
```

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	B34	26.	.65	3.	3.	3.	.02		
+	ROUTED TO	J-J	24.	.73	3.	3.	3.	.02		
+									.41	.73
+	HYDROGRAPH AT	500C	15.	.65	2.	2.	2.	.01		
+	2 COMBINED AT	DP345	37.	.70	5.	5.	5.	.04		
+	HYDROGRAPH AT	B5	47.	.67	6.	6.	6.	.04		
+	HYDROGRAPH AT	B6	25.	.67	3.	3.	3.	.02		
+	2 COMBINED AT	DP56	72.	.67	9.	9.	9.	.06		
+	ROUTED TO	K-K	66.	.73	9.	9.	9.	.06		
+									.94	.73
+	HYDROGRAPH AT	500A	31.	.72	4.	4.	4.	.04		
+	3 COMBINED AT	DP500	133.	.72	19.	19.	19.	.14		

+	HYDROGRAPH AT	500B	9.	.65	1.	1.	1.	.01		
+	2 COMBINED AT	DP501	141.	.72	20.	20.	20.	.15		
+	HYDROGRAPH AT	B7	17.	.63	2.	2.	2.	.01		
+	HYDROGRAPH AT	B8-1	66.	.65	8.	8.	8.	.06		
+	HYDROGRAPH AT	B8-2	20.	.60	2.	2.	2.	.02		
+	2 COMBINED AT	DP7	86.	.63	10.	10.	10.	.07		
+	HYDROGRAPH AT	B8-3	20.	.77	3.	3.	3.	.02		
+	3 COMBINED AT	DP7A	117.	.65	16.	16.	16.	.11		
+	HYDROGRAPH AT	400A	16.	.78	2.	2.	2.	.02		
+	2 COMBINED AT	DP401	128.	.65	18.	18.	18.	.13		
+	HYDROGRAPH AT	400B	8.	.78	1.	1.	1.	.01		
+	2 COMBINED AT	DP402	134.	.67	19.	19.	19.	.14		
+	HYDROGRAPH AT	B1A	30.	.68	4.	4.	4.	.02		
+	HYDROGRAPH AT	B1B	234.	.83	39.	39.	39.	.23		
+	HYDROGRAPH AT	B1C	41.	.77	6.	6.	6.	.04		
+	2 COMBINED AT	DP1BC	273.	.83	45.	45.	45.	.27		
+	ROUTED TO	A-A	271.	.87	45.	45.	45.	.27		
+									2.24	.87
+	HYDROGRAPH AT	B1D	93.	.52	8.	8.	8.	.05		
+	2 COMBINED AT	DP1ABC	302.	.85	53.	53.	53.	.32		
+	ROUTED TO	C-C	275.	.95	53.	53.	53.	.32		
+									2.98	.95
+	HYDROGRAPH AT	BA	69.	.82	11.	11.	11.	.09		
+	2 COMBINED AT	DP1	335.	.93	65.	65.	65.	.41		
+	HYDROGRAPH AT	B2	51.	.73	7.	7.	7.	.04		
+	ROUTED TO	D-D	26.	1.08	7.	7.	7.	.04		
+									.79	1.08
+	HYDROGRAPH AT	B2X	7.	.65	1.	1.	1.	.00		
+	ROUTED TO	X-X	7.	.65	1.	1.	1.	.00		

+									.08	.65
+	HYDROGRAPH AT	BC	78.	.73	11.	11.	11.	.09		
+	3 COMBINED AT	DP2	99.	.75	19.	19.	19.	.14		
+	HYDROGRAPH AT	B3	70.	.83	11.	11.	11.	.07		
+	ROUTED TO	E-E	37.	1.27	11.	11.	11.	.07		
+									1.20	1.27
+	HYDROGRAPH AT	B4	109.	.77	16.	16.	16.	.10		
+	ROUTED TO	F-F	92.	.88	16.	16.	16.	.10		
+									1.80	.88
+	HYDROGRAPH AT	BH	26.	.73	4.	4.	4.	.03		
+	3 COMBINED AT	DP3	135.	.92	31.	31.	31.	.19		
+	HYDROGRAPH AT	BB	18.	.68	3.	3.	3.	.02		
+	HYDROGRAPH AT	BD	18.	.72	3.	3.	3.	.02		

*** NORMAL END OF HEC-1 ***

```
1***************************************                    ***************************************
 *                                     *                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                   *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990            *                    *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0             *                    *        609 SECOND STREET            *
 *                                     *                    *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  02/24/1998  TIME  09:39:28 *                  *         (916) 756-1104              *
 *                                     *                    *                                     *
***************************************                    ***************************************


                      X     X  XXXXXXX   XXXXX          X
                      X     X  X        X     X        XX
                      X     X  X        X               X
                      XXXXXXX  XXXX     X       XXXXX   X
                      X     X  X        X               X
                      X     X  X        X     X         X
                      X     X  XXXXXXX   XXXXX         XXX


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                         HEC-1 INPUT                                              PAGE  1

  LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

     1      ID        BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
     2      ID         100YR,2HR      DEVELOPED          PART 2
     3      ID        FULL BASIN RUNOFF STUDY            100BD2.DAT
            *DIAGRAM
     4      IT       1 01DEC97    1200     1500
     5      IN       5
     6      IO       5       0

     7      KK      BE
     8      KM        RUNOFF FROM BASIN E
     9      BA    0.01
    10      PB     3.1
    11      PI     .01     .03     .04     .07     .12     .22     .12     .07     .05     .04
    12      PI     .03     .03     .03     .02     .02     .01     .01     .01     .01     .01
    13      PI     .01     .01     .01     .01
    14      LS       0      72       5
    15      UD    0.14

    16      KK      BF
    17      KM        RUNOFF FROM BASIN F
    18      BA    0.13
    19      LS       0      72       5
    20      UD    0.13

    21      KK      BG
    22      KM        RUNOFF FROM BASIN G
    23      BA    0.03
    24      LS       0      72       5
    25      UD    0.19

    26      KK   B12-1
    27      KM        RUNOFF FROM SDA 12-1
    28      BA    .089
    29      LS       0      76       6
    30      UD    .126

    31      KK   B12-2
    32      KM        RUNOFF FROM SDA 12-2
    33      BA    .028
    34      LS       0      76       6
    35      UD    .113
```

```
  36          KK     DP1
  37          KM        COMBINE FLOWS FROM SDAs 12-1, 12-2
  38          HC       2

  39          KK     A-A
  40          KM        ROUTE FLOWS FROM CP1 TO CP2
  41          RS       1    STOR       0
  42          RC    0.12     .08    0.12     630    0.24
  43          RX       0       5      10      20      28      38      43      48
  44          RY      15    12.5      10       0       0      10    12.5      15
1                                          HEC-1 INPUT                                         PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  45          KK    B12-3
  46          KM        RUNOFF FROM SDA 12-3
  47          BA    .027
  48          LS       0      76       6
  49          UD    .145

  50          KK    B12-4
  51          KM        RUNOFF FROM SDA 12-4
  52          BA    .038
  53          LS       0      75       6
  54          UD    .110

  55          KK    B12-7
  56          KM        RUNOFF FROM SDA 12-7
  57          BA    .016
  58          LS       0      75       5
  59          UD    .134

  60          KK     DP2
  61          KM        COMBINE CP1 & SDAs 12-3, 12-4, 12-7
  62          HC       4

  63          KK     B-B
  64          KM        ROUTE FLOWS FROM CP2 TO CP3
  65          RS       1    STOR       0
  66          RC    0.12     .08    0.12     790    0.19
  67          RX       0       5      10      20      28      38      43      48
  68          RY      15    12.5      10       0       0      10    12.5      15

  69          KK    B12-5
  70          KM        RUNOFF FROM SDA 12-5
  71          BA    .081
  72          LS       0      76      10
  73          UD    .154

  74          KK    B12-8
  75          KM        RUNOFF FROM SDA 12-8
  76          BA    .023
  77          LS       0      75       5
  78          UD    .077

  79          KK     DP3
  80          KM        COMBINE FLOWS FROM CP2 & SDAs 12-5, 12-8
  81          HC       3

  82          KK     C-C
  83          KM        ROUTE FLOW FROM CP3 TO CP4
  84          RS       1    STOR       0
  85          RC    0.12     .08    0.12     650    0.26
  86          RX       0       5      10      20      28      38      43      48
  87          RY      15    12.5      10       0       0      10    12.5      15
1                                          HEC-1 INPUT                                         PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  88          KK    B12-6
  89          KM        RUNOFF FROM SDA 12-6
  90          BA    .061
  91          LS       0      76      10
  92          UD    .129

  93          KK    B12-9
  94          KM        RUNOFF FROM SDA 12-9
```

```
 95      BA    .021
 96      LS      0       75        4
 97      UD    .112

 98      KK      DP4
 99      KM         COMBINE FLOWS FROM CP3 & SDAs 12-6, 12-9
100      HC       3

101      KK      D-D
102      KM         ROUTE FLOWS FROM CP4 TO CP5
103      RS       1     STOR       0
104      RC    0.12      .08    0.12    1420    0.19
105      RX       0        5      10      20      28      38      43      48
106      RY      15     12.5      10       0       0      10    12.5      15

107      KK    B1210
108      KM         RUNOFF FROM SDA 12-10
109      BA    .069
110      LS      0       75        5
111      UD    .170

112      KK      DP5
113      KM         COMBINE FLOWS FROM CP4 & SDA 1210
114      HC       2

115      KK      E-E
116      KM         ROUTE FLOW FROM CP5 TO CP6
117      RS       1     STOR       0
118      RC    0.12      .08    0.12    1420    0.11
119      RX       0        5      10      20      28      38      43      48
120      RY      15     12.5      10       0       0      10    12.5      15

121      KK      DAM
122      KM         ROUTE FLOW THROUGH FISHERS CNAYON DEBRIS CONTROL STURCTURE
123      RS       1     ELEV    7155
124      SV       0      0.3    0.75    1.35    2.55     3.6     3.8     6.1     8.5    11.0
125      SV    13.5     16.1    18.8
126      SE    7155     7160    7165    7170    7175    7178    7180    7182    7184    7186
127      SE    7188     7190    7192
128      SQ       0       19      39      51      61      67      70     158     197     227
129      SQ    1853     4801    8610
1                                        HEC-1 INPUT                                          PAGE  4

LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


130      KK    B1211
131      KM         RUNOFF FROM SDA 12-11
132      BA    .041
133      LS      0       74       10
134      UD    .073

135      KK      DP6
136      KM         COMBINE DP5 & 1211
137      HC       2

138      KK      F-F
139      KM         ROUTE FLOW FROM 12-11 TO 1011-1
140      RS       1     STOR       0
141      RC    0.12      .08    0.12    1200     .13
142      RX       0        5      10      20      28      38      43      48
143      RY      15     12.5      10       0       0      10    12.5      15

144      KK   B10111
145      KM         RUNOFF FROM SDA 1011-1
146      BA    .035
147      LS      0       74        7
148      UD    .160

149      KK   B10112
150      KM         RUNOFF FROM SDA 1011-2
151      BA    .037
152      LS      0       74        7
153      UD    .160

154      KK      DP8
155      KM         COMBINE FLOW FROM SDA 1012 & CP6A
156      HC       3

157      KK      G-G
```

```
 158            KM        ROUTE FLOW FROM DP8 TO DP300
 159            RS        1    STOR      0
 160            RC     0.12     .08   0.12    1200     .12
 161            RX        0       5     10      20      28      38      43      48
 162            RY       15    12.5     10       0       0      10    12.5      15

 163            KK     300A
 164            KM        RUNOFF FROM 300A
 165            BA     .049
 166            LS        0      65      4
 167            UD     .162

 168            KK    DP300
 169            KM        COMBINE FLOWS FROM CP8 & SDA 300A
 170            HC        2
1                                             HEC-1 INPUT                                              PAGE  5

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 171            KK       B9
 172            KM        RUNOFF FROM SDA 9
 173            BA     .085
 174            LS        0      74      4
 175            UD     .125

 176            KK      H-H
 177            KM        ROUTE FLOW FROM B9 THRU SDA 300B
 178            RS        1    STOR      0
 179            RC     0.12     .08   0.12    1200     .25
 180            RX        0       5     10      20      28      38      43      48
 181            RY       15    12.5     10       0       0      10    12.5      15

 182            KK     300B
 183            KM        RUNOFF FROM 300B
 184            BA     .026
 185            LS        0      68      4
 186            UD     .126

 187            KK      DP9
 188            KM        COMBINE SDA B9 & 300B
 189            HC        2

 190            KK    DP301
 191            KM        COMBINE FLOWS FROM CP300 & SDA 300B
 192            HC        2

 193            KK      I-I
 194            KM        ROUTE FLOW FROM B9 THRU SDA 300B
 195            RS        1    STOR      0
 196            RC     0.12     .08   0.12    1800     .17
 197            RX        0       4    5.5     6.5    14.5    15.5      17      21
 198            RY        7       5      2       0       0       2       5       7

 199            KK     300C
 200            KM        RUNOFF FROM SDA 300C
 201            BA      .06
 202            LS        0      72      4
 203            UD     .150

 204            KK    DP302
 205            KM        COMBINE FLOWS FROM CP301 & 300C
 206            HC        2
 207            ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7          BE
               .
               .
  16           .          BF
               .           .
               .           .
  21           .           .          BG
               .           .           .
               .           .           .
```

```
26    .         .         .       B12-1
      .         .         .           .
      .         .         .           .
31    .         .         .           .       B12-2
      .         .         .           .           .
      .         .         .           .           .
36    .         .         .         DP1............
      .         .         .           V
      .         .         .           V
39    .         .         .         A-A
      .         .         .           .
      .         .         .           .
45    .         .         .           .       B12-3
      .         .         .           .           .
      .         .         .           .           .
50    .         .         .           .           .       B12-4
      .         .         .           .           .           .
      .         .         .           .           .           .
55    .         .         .           .           .           .       B12-7
      .         .         .           .           .           .           .
      .         .         .           .           .           .           .
60    .         .         .         DP2....................................
      .         .         .           V
      .         .         .           V
63    .         .         .         B-B
      .         .         .           .
      .         .         .           .
69    .         .         .           .       B12-5
      .         .         .           .           .
      .         .         .           .           .
74    .         .         .           .           .       B12-8
      .         .         .           .           .           .
      .         .         .           .           .           .
79    .         .         .         DP3........................
      .         .         .           V
      .         .         .           V
82    .         .         .         C-C
      .         .         .           .
      .         .         .           .
88    .         .         .           .       B12-6
      .         .         .           .           .
      .         .         .           .           .
93    .         .         .           .           .       B12-9
      .         .         .           .           .           .
      .         .         .           .           .           .
98    .         .         .         DP4........................
      .         .         .           V
      .         .         .           V
101   .         .         .         D-D
      .         .         .           .
      .         .         .           .
107   .         .         .           .       B1210
      .         .         .           .           .
      .         .         .           .           .
112   .         .         .         DP5............
      .         .         .           V
      .         .         .           V
115   .         .         .         E-E
      .         .         .           V
      .         .         .           V
121   .         .         .         DAM
      .         .         .           .
      .         .         .           .
130   .         .         .           .       B1211
      .         .         .           .           .
      .         .         .           .           .
135   .         .         .         DP6............
      .         .         .           V
      .         .         .           V
138   .         .         .         F-F
      .         .         .           .
      .         .         .           .
144   .         .         .           .      B10111
      .         .         .           .           .
      .         .         .           .           .
149   .         .         .           .           .      B10112
      .         .         .           .           .           .
      .         .         .           .           .           .
154   .         .         .         DP8........................
      .         .         .           V
```

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                .              .              .           V
157             .              .              .          G-G
                .              .              .           .
                .              .              .           .
163             .              .              .           .          300A
                .              .              .           .             .
                .              .              .           .             .
168             .              .              .        DP300............
                .              .              .           .
                .              .              .           .
171             .              .              .           .           B9
                .              .              .           .            V
                .              .              .           .            V
176             .              .              .           .           H-H
                .              .              .           .            .
                .              .              .           .            .
182             .              .              .           .            .          300B
                .              .              .           .            .             .
                .              .              .           .            .             .
187             .              .              .           .           DP9............
                .              .              .           .            .
                .              .              .           .            .
190             .              .              .        DP301............
                .              .              .           V
                .              .              .           V
193             .              .              .          I-I
                .              .              .           .
                .              .              .           .
199             .              .              .           .          300C
                .              .              .           .             .
                .              .              .           .             .
204             .              .              .        DP302............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*              VERSION 4.0              *
*                                       *
*  RUN DATE  02/24/1998  TIME  09:39:28 *
*                                       *
*****************************************

****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
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                    BOULDERS BROADMOOR COMMUNITY MASTER DRAINAGE PLAN
                     100YR,2HR      DEVELOPED         PART 2
                    FULL BASIN RUNOFF STUDY           100BD2.DAT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          1  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1DEC97  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1DEC97  ENDING DATE
                   NDTIME       1659  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .02 HOURS
                     TOTAL TIME BASE    4.98 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BE	9.	.68	1.	1.	1.	.01		
+	HYDROGRAPH AT	BF	123.	.67	16.	16.	16.	.13		
+	HYDROGRAPH AT	BG	25.	.75	4.	4.	4.	.03		
+	HYDROGRAPH AT	B12-1	112.	.65	14.	14.	14.	.09		
+	HYDROGRAPH AT	B12-2	37.	.63	4.	4.	4.	.03		
+	2 COMBINED AT	DP1	148.	.65	18.	18.	18.	.12		
+	ROUTED TO	A-A	148.	.67	18.	18.	18.	.12		
+									1.51	.67
+	HYDROGRAPH AT	B12-3	32.	.68	4.	4.	4.	.03		
+	HYDROGRAPH AT	B12-4	47.	.63	6.	6.	6.	.04		
+	HYDROGRAPH AT	B12-7	18.	.67	2.	2.	2.	.02		
+	4 COMBINED AT	DP2	244.	.67	30.	30.	30.	.20		
+	ROUTED TO	B-B	242.	.68	30.	30.	30.	.20		
+									2.15	.68
+	HYDROGRAPH AT	B12-5	102.	.68	13.	13.	13.	.08		
+	HYDROGRAPH AT	B12-8	31.	.60	3.	3.	3.	.02		
+	3 COMBINED AT	DP3	369.	.67	47.	47.	47.	.30		
+	ROUTED TO	C-C	369.	.68	47.	47.	47.	.30		
+									2.52	.68
+	HYDROGRAPH AT	B12-6	82.	.65	10.	10.	10.	.06		
+	HYDROGRAPH AT	B12-9	25.	.65	3.	3.	3.	.02		
+	3 COMBINED AT	DP4	472.	.68	60.	60.	60.	.38		
+	ROUTED TO	D-D	466.	.70	60.	60.	60.	.38		
+									3.16	.70
+	HYDROGRAPH AT	B1210	72.	.72	10.	10.	10.	.07		
+	2 COMBINED AT	DP5	537.	.70	71.	71.	71.	.45		
+	ROUTED TO	E-E	527.	.73	71.	71.	71.	.45		

+									3.93	.73
+	ROUTED TO	DAM	222.	1.18	71.	71.	71.	.45		
+									7185.67	1.18
+	HYDROGRAPH AT	B1211	57.	.58	6.	6.	6.	.04		
+	2 COMBINED AT	DP6	240.	1.12	77.	77.	77.	.49		
+	ROUTED TO	F-F	239.	1.13	77.	77.	77.	.49		
+									2.41	1.13
+	HYDROGRAPH AT	B10111	37.	.70	5.	5.	5.	.04		
+	HYDROGRAPH AT	B10112	39.	.70	5.	5.	5.	.04		
+	3 COMBINED AT	DP8	274.	1.10	87.	87.	87.	.57		
+	ROUTED TO	G-G	274.	1.10	87.	87.	87.	.57		
+									2.64	1.10
+	HYDROGRAPH AT	300A	25.	.75	4.	4.	4.	.05		
+	2 COMBINED AT	DP300	293.	.95	91.	91.	91.	.62		
+	HYDROGRAPH AT	B9	91.	.67	12.	12.	12.	.09		
+	ROUTED TO	H-H	89.	.68	12.	12.	12.	.09		
+									1.07	.68
+	HYDROGRAPH AT	300B	18.	.68	3.	3.	3.	.03		
+	2 COMBINED AT	DP9	107.	.68	14.	14.	14.	.11		
+	2 COMBINED AT	DP301	362.	.87	106.	106.	106.	.73		
+	ROUTED TO	I-I	361.	.90	106.	106.	106.	.73		
+									2.96	.90
+	HYDROGRAPH AT	300C	53.	.70	7.	7.	7.	.06		
+	2 COMBINED AT	DP302	399.	.88	113.	113.	113.	.79		

*** NORMAL END OF HEC-1 ***

Subject BOULDERS BROADMOOR - WECI FLOW SCHEMATIC (FULL BASIN) Project No. 21505

By TLD Checked By SWR Task No. 001

File No.

Date 12/2/97 Date 12/28/97 Sheet 1/1

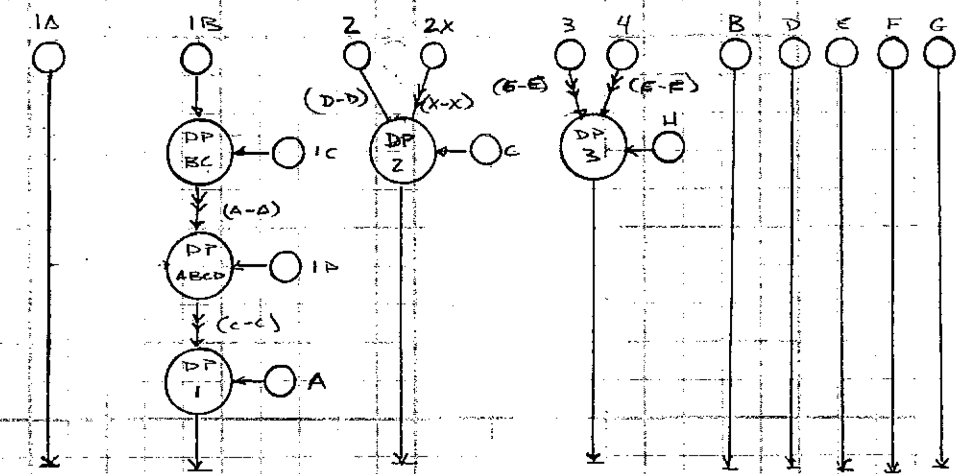
OBJECTIVE:

DEVELOP FLOW SCHEMATIC FOR FULL BASIN ANALYSIS

GIVEN:

SITE TOPO.

SOLUTION:



NOTE: REVISED 12/18 TO INCLUDE NEW DRAINAGE AREA 2X.

Woodward-Clyde

Subject BOULDERS BROADMOOR - SUPPLEMENTAL BASIN | Project No. 24505
By SOTS | Checked By SWR | Task No. 001
File No.
Date 12/17/97 | Date 1/28/97 | Sheet 1/1

OBJECTIVE:

ESTIMATE BASIN CHARACTERISTICS FOR SUB-BASIN 2X

GIVEN:

SITE TOPO

SOLUTION:

ID	AREA (mi²)	AVG SLOPE (F/F)	L OVERLAND (FT)	$t_{c_o}^{(1)}$ (MIN)	L CHANNEL (FT)	$t_{c_1}^{(2)}$ (MIN)	$t_{c_2}^{(3)}$ (MIN)	LAG (HR)
2X	0.005	0.49	50	12.1	490	1.2	13.3	0.13

(1) $107n((0.3L)^{0.33})/(S)^{0.2}$
(2) $0.0078\,L^{0.77}\,S^{-0.385}$
(3) $t_{c_1} + t_{c_2}$
$n = 0.04$

Subject: BOULDERS BROADMOOR - HYDROLOGIC CHARACTERISTICS Project No. 21150G

By: [illegible] Checked By: SWR Task No. 301

File No.

Date: 12/2/96 Date: 1/28/97 Sheet: 1

OBJECTIVE:

DEVELOP SUMMARY OF BASIN HYDROLOGIC CHARACTERISTICS FOR DEVELOPED BOULDERS BROADMOOR COMMUNITY

GIVEN:

SITE TOPO (KIOWA 1"=100')

SOLUTION:

NOTE FROM PREVIOUS KIOWA BASIN DELINEATION: SUB-BASINS TO BE COMBINED UNDER 1 BASIN ID (I.E. A1..A11 → A, B1 → B, C1-10 → C, ETC.)

BASIN ID	AREA (MI^2)	AVG SLOPE (F/F)	$L_{OVERLAND}$ (FT)	t_{c_0} [1] (MIN)	$L_{CHANNEL}$ (FT)	t_{c_1} [2] (MIN)	t_{c_t} [3] (MIN)	LAG [4] (HR)	L_{ADJ} [7]
A [5]	0.091	0.26	190	21.3	1340	3.4	24.7	0.25	0.23
B [6]	0.018	0.17	70	14.6	130	0.7	15.3	0.15	0.14
C [6]	0.088	0.17	140	18.3	2200	1.0	19.3	0.19	0.17
D [5]	0.023	0.17	40	13.9	400	1.6	15.5	0.16	—
E [5]	0.010	0.18	40	12.0	360	1.5	13.5	0.14	—
F [6]	0.009	0.18	50	12.9	—	0	12.9	0.13	0.12
G [6]	0.034	0.20	100	15.9	560	1.9	17.8	0.18	0.16
H [7]	0.030	0.22	110	16.1	840	2.5	18.6	0.19	0.17

(1) $167\, n\, ((0.34)^{0.35}) / (S)^{0.2}$

(2) $0.0078\, L^{0.77} S^{-0.385}$

(3) $t_{c_1} + t_{c_2}$

(4) (3) · 0.6 / 60

(5) $n = 0.04$ } SUGGESTED n-VALUES (TR-55)

(6) $n = 0.035$ }

(7) ADJUSTED LAG TIME, REDUCED BY 10% FOR DEVELOPED CONDITIONS

Subject BOULDERS BROADWOOD - WATERSHED CHARACTERISTICS Project No. 24506

By SWD Checked By SWR Task No. 001

File No.

Date 12/1/97 Date 1/28/97 Sheet 1

OBJECTIVE:

DEVELOP WATERSHED CHARACTERISTICS FOR BOULDER BROADMOOR

GIVEN:

SITE TOPO

SOLUTION:

BASIN ID	AREA (mi^2)	AVG SLOPE (F/F)	L_{OVRLND} (FT)	t_{L_0} (1) (MIN)	L_{CHNL} (FT)	t_{L_1} (2) (MIN)	t_{L_2} (3) (MIN)	LAG (4) (HR)
1A	0.023	0.27	100	10.70	1200	4.17	14.87	0.15
1B	0.231	0.36	1000	21.32	3000	5.39	26.71	0.27
1C	0.037	0.70	1100	19.47	1550	2.56	22.03	0.22
1D	0.050	0.20	0	0.0	1300	3.62	3.62	0.04
2	0.043	0.40	300	14.18	2500	4.59	18.77	0.19
3	0.0687	0.25	600	19.59	2800	6.00	25.59	0.26
4	0.096	0.50	500	16.06	3200	5.09	21.15	0.21

(1) $107\, n\, ((0.3L)^{0.33})/(S)^{0.2}$

(2) $0.0078\, L^{0.77}\, S^{-0.385}$

(3) $t_{c1} + t_{c2}$

(4) $(3) \cdot 0.6$

SUMMARY OF WATERSHED CHARACTERISTICS
BOULDERS BROADLANDS

Watershed	Area		Average S	Overland	tc	Channel	tc Kirpich	Total	Time lag
	ft2	acres		ft		ft	min	Min	hr
1A	635811.3 0.023	15	0.27	100	10.70	1800	4.17	14.87	~~0.15~~ [illegible]
1B	6435613.1 0.231	148	0.38	1000	21.32	3000	5.39	26.71	~~0.27~~ [illegible]
1C	1020522 0.037	23	0.70	1100	19.47	1550	2.56	22.03	~~0.22~~ [illegible]
1D	1392523 0.050	32	0.20	0	0.00	1300	3.62	3.62	~~0.04~~ [illegible]
		218							
2	1193502.3 0.043	27	0.40	300	14.18	2500	4.59	18.77	~~0.19~~ [illegible]
3	19145638 $\times 10^{-1}$ 0.687	440	0.25	600	19.59	2800	6.00	25.59	~~0.26~~ [illegible]
4	2674065.3 0.096	61	0.50	500	16.06	3200	5.09	21.15	~~0.21~~ [illegible]
Total		746							

Overland tc= 107*n*((0.3*L)^0.33)/(S^0.2)
Kirpich= 0.0078*L^0.77*(s^-0.385)

Exhibit A-1, continued: Hydrologic soil groups for United States soils

Soil	Group
CHOBEE, LIMESTONE SUBSTRATUM	D
CHOCCOLOCCO	B
CHOCK	D
CHOCORUA	D
CHOICE	D
CHOOP	D
CHOPTIE	D
CHORALMONT	B
CHOSKA	B
CHOTEAU	C
CHOVAN	D
CHRIS	C
CHRISMAN	D
CHRISTIAN	C
CHRISTIANA	C
CHRISTIANBURG	C
CHRISTINE	D
CHRISTOFF	C
CHRISTY	C
CHRODER	B
CHROME	C
CHRYSLER	C
CHUALAR	B
CHUBBS	C
CHUCKANUT	B
CHUCKAWALLA	B
CHUCKLES	B
CHUCKRIDGE	D
CHUGCREEK	C
CHUGTER	B
CHUIT	B
CHULITNA	B
CHUMALL	B
CHUNNY	D
CHUMSTICK	D
CHUPADERA	C
CHURCH	D
CHURCHILL	D
CHURCHVILLE	D
CHURN	B
CHUSKA	D
CHUTE	A
CIALES	D
CIBEQUE	B
CIBO	D
CIBOLA	B
CID	C
CIDRAL	C
CIENEBA	C
CIENO	D
CIERVO, ALKALI	D
CIERVO, ALKALI, WET	D
CIERVO, RECLAIMED	C
CIFIC	C
CIMARRON	C
CINCINNATI	C
CINCO	A
CINDERHURST	D
CINEBAR	B
CINNADALE	D
CINNAMON	B
CINTRONA	D
CIPRIANO	D
CIRAC	B
CIRCLEBACK	A
CIRCLEBAR	C
CIRCLEVILLE	C
CISCO	B
CISNE	D
CISPUS	B
CITADEL	C
CITICO	B
CITRONELLE	D
CLACKAMAS	D
CLAIBORNE	B
CLAIRE	A
CLAIREMONT	B
CLALLAM	C
CLAM GULCH	D
CLAMO	C/D
CLAMP	D
CLANA	A
CLANALPINE	C
CLANTON	C
CLAPPER	B
CLAREMORE	D
CLARENCE	D
CLARENDON	C
CLARESON	C
CLAREVILLE	C
CLARINDA	D
CLARION	B
CLARITA	D
CLARK	B
CLARK FORK	A
CLARKELEN	B
CLARKRANGE	C
CLARKSBURG	C
CLARKSDALE	C
CLARKSVILLE	B
CLARNO	B
CLATO	B
CLATSOP	D
CLAUNCH	B
CLAVERACK	C
CLAVICON	C
CLAWSON	C
CLAYBURN	B
CLAYSPRINGS	D
CLAYTON	B
CLE ELUM	C
CLEAR LAKE	D
CLEAR LAKE, STRATIFIED SUBSTRATUM	C
CLEAR LAKE, MODERATELY WET	C
CLEARBROOK	D
CLEARFIELD	C
CLEARFORK	D
CLEARWATER	D
CLEAVAGE	D
CLEAVER	D
CLEAVMOR	D
CLEBIT	D
CLEGG	B
CLEGHORN	C
CLEMAN	B
CLEMENTINE	C
CLEMENTINE, DRAINED	B
CLEMS	B
CLEMVILLE	B
CLENDENEN	D
CLEONE	B
CLEORA	B
CLERF	C
CLERGERN	B
CLERMONT	D
CLEVELAND	C
CLEVERLY	B
CLICK	A
CLIFFDELL	B
CLIFFDOWN	B
CLIFFHOUSE	C
CLIFFORD	C
CLIFSAND	B
CLIFTERSON	B
CLIFTON	B
CLIFTY	B
CLIMARA	D
CLIMAX	D
CLINE	C
CLINETOP	D
CLINT	C
CLINTON	B
CLIPPER	D
CLIPPER, DRAINED	C
CLODINE	D
CLONTARF	B
CLOQUALLUM	C
CLOQUATO	B
CLOQUET	B
CLOSKEY	C
CLOTHO	C/D
CLOUD PEAK	C
CLOUD RIM	B
CLOUDCROFT	D
CLOUDLAND	C
CLOUGH	D
CLOVELLY	D
CLOVER SPRINGS	B
CLOVERDALE	D
CLOVERLAND	C
CLOVIS	B
CLOWERS	B
CLOWERS, WET	C
CLOWFIN	B
CLUFF	C
CLUNIE	C
CLURDE	B
CLURO	B
CLYDE	B/D
CLYMER	B
COACHELLA	B
COACHELLA, WET	C
COAHUILA	B
COAL CREEK	D
COALBANK	B
COALDALE	D
COALDRAW	D
COALMONT	C
COAMO	C
COARSEGOLD	C
COATSBURG	D
COBAT	B
COBATUS	C
COBB	B
COBBSFORK	D
COBEN	D
COBEY	B
COBLE	D
COBOC	C
COBRE	C
COBURG	C
COCHETOPA	C
COCHINA	D
COCHITI	C
COCHRAN	C
COCOA	A
COCODRIE	C
COCOLALLA	D
COCOLALLA, DRAINED	C
COOLEY	B
CODORUS	C
CODOQUIN	D
CODYLAKE	B
COE	A
COEROCK	D
COESSE	C/D
COFF	C
COFFEEN	B
COGGON	B
COGNA	B
COGSWELL	C
COHAGEN	D
COHASSET	B
COHOCTAH	B/D
COHOCTAH, SANDY SUBSTRATUM	D
COHOE	B
COILS	C
COIT	D
COKEDALE	D
COKEDALE, DRAINED	C
COKEL	B
COKER	D
COKESBURY	D
COKEVILLE	B
COLAND	B/D
COLBAR	C
COLBERT	D
COLBURN	C
~~COLBY~~	B
COLDCREEK	B
COLDENT	C
COLE	C
COLEMAN	C
COLEMANTOWN	C/D
COLESTINE	C
COLFAX	C
COLHILL	B
COLIBRO	B
COLINAS	B
COLITA	D
COLLAMER	C
COLLARD	C
COLLAYOMI	B
COLLBRAN	D
COLLBRAN, COBBLY	C
COLLEGEDALE	C
COLLEGIATE	D
COLLETT	
COLLETT, DRAINED	C
COLLIER	A
COLLINGTON	B
COLLINS	C
COLLINSTON	B
COLLINSVILLE	D
COLLINWOOD	C
COLMA	B
COLMOR	B
COLNEVEE	B
COLO	B/D
COLO, DRAINED	B
COLO, NONFLOODED	B
COLOCKUM	B
COLOMA	A
COLOMBO	B
COLONA	C
COLONIE	A
COLONVILLE	C
COLORADO	B
COLOROCK	D
COLOROW	B
COLOSO	D
COLOSSE	A
COLP	C
COLRAIN	B
COLSAVAGE	C
COLTER	B
COLTHORP	D
COLTON	A
COLTROOP	C
COLTS NECK	B
COLUMBIA, MUCK SUBSTRATUM	B
COLUMBIA, DRAINED, CLAY SUBSTRATUM	B
COLUMBIA, MODERATELY WET	C
COLUMBIA, DRAINED	B
COLUMBIA, FLOODED	C
COLUMBIA, CLAY SUBSTRATUM	C
COLUMBIA, SLOPING	B
COLUMBINE	A
COLUMBUS	C
COLUSA	C
COLVARD	B
COLVILLE	D
COLVILLE, DRAINED	C
COLVIN	C/D
COLVIN, SALINE	C
COLVIN, OVERBLOWN, SALINE	C
COLWOOD	B/D
COLY	B
COLYER	D
COMAD	A
COMAR	C
COMBE	B
COMBS	B
COMER	B
COMETA	D
COMFORT	D
COMFREY	B/D
COMFREY, PONDED	D
COMITAS	A
COMLY	C
COMMERCE	C
COMMSKI	B
COMO	A
COMORAEI	D
COMODORE	D
COMORO	B
COMPASS	B
COMPTCHE	B
COMSTOCK	C
COMUS	B
CONA	C
CONABY	B/D
CONALB	B
CONANT	C
CONASAUGA	C
CONATA	D
CONBOY	D
CONCEPCION	D
CONCHAS	C
CONCHO	C
CONCONULLY	B
CONCORD	D
CONDA	D
CONDIE	B
CONDIT	D
CONDON	C
CONE	A
CONECUH	D
CONEJO	B
CONEJO, WET	C
CONEJO, GRAVELLY SUBSTRATUM	C
CONESTOGA	B
CONESUS	B
CONETOE	A
CONGAREE	B
CONGER	C
CONGER, COBBLY SUBSTRATUM	D
CONGLE	B
CONI	D
CONIC	C
CONLEN	B
CONLEY	C
CONNEAUT	C
CONNEL	B
CONNERTON	B
CONOSTA	C
CONOTTON	B
CONOVER	C
CONOWINGO	C
CONPEAK	D
CONRAD	A/D
CONROE	B
CONSEJO	C
CONSER	D
CONSTABLE	A
CONSTANCIA	D
CONSUMO	B
CONTACT	A
CONTEE	D
CONTIDE	B
CONTINE	C

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

Exhibit A-1, continued: Hydrologic soil groups for United States soils

Soil	Group
HUNNTON	C
HUNSINGER	B
HUNTERS	B
HUNTERSVILLE	B
HUNTIMER	C
HUNTING	C
HUNTINGTON	B
HUNTMOUNT	B
HUNTROCK	B
HUNTSBURG	D
HUNTSVILLE	B
HUPP	B
HURDS	B
HURLBUT	C
HURLEY	D
HURRICANE	C
HURRY BACK	B
HURRYBACK	B
HURST	D
HURWAL	B
HUSE	D
HUSKA	D
HUSSA	D
HUSSA, CLAYEY SUBSTRATUM	C
HUSSA, MODERATELY WET	C
HUSSA, DRAINED	B
HUSSELL	B
HUSSMAN	D
HUSUM	B
HUTCHINSON	C
HUTCHLEY	D
HUTSON	B
HUTT	D
HUTTON	D
HUXLEY	C
HUYSINK	B
HYALL	C
HYANNIS	B
HYAS	B
HYATTVILLE	C
HYDABURG	D
HYDE	B/D
HYDER	D
HYDRO	C
HYE	B
HYLOC	D
HYMAS	D
HYPRAIRIE	B
HYRUM	B
HYSHAM	D
HYSHOT	D
HYTOP	D
HYZEN	B
IAO	B
IBERIA	D
ICARIA	D
ICENE	D
ICESLEY	D
ICHBOD	D
ICHETUCKNEE	D
ICICLE	B
IDA	B
IDABEL	B
IDAHOME	B
IDAMONT	B
IDEE	C
IDLEWILD	D
IDLEWILD, DRAINED	C
IDMON	B
IGDELL	C
IGERT	C
IGNACIO	C
IGO	D
IGUALDAD	D
IHLEN	B
IJAM	D
ILACHETOMEL	B
ILDECARE	B
ILDEFONSO	B
ILES	C
ILIFF	C
ILIILI	D
ILION	D
ILLABOT	C
ILLAHEE	B
ILLER	B
ILLITO	D
ILTON	C
ILWACO	B
IMA	B
IMBLER	B
IMLAY	D
IMNIG	C
IMMIGRANT	C
IMMOKALEE	B/D
IMMOKALEE, DEPRESSIONAL	D
IMOGENE	D
IMONIL	B
IMPACT	A
IMPERIAL	D
INARAJAN	D
INARAJAN, STRATIFIED SUBSTRATUM	C
INAVALE	A
INCELL	D
INCHAU	C
INCHELIUM	B
INCY	A
INDART	C
INDEX	A
INDIAHOMA	D
INDIAN CREEK	D
INDIANO	C
INDIANOLA	A
INDIO	B
INDLETON	B
INDUS	D
INEZ	D
INFERNAL	D
INGALLS	B
INGENIO	B
INGERSOLL	B
INGRAM	D
INKLER	B
INKOM	D
INKOM, DRAINED	C
INKOSR	D
INKS	D
INKSTER	B
INLOW	C
INMACHUK	D
INMAN	C
INMO	A
INNINGER	C
INPENDENCE	B
INSAK	D
INSIDERT	C
INSKIP	C
INSULA	D
INTERIOR	B
INTON	B
INVERNESS	B
INVERSHIEL	C
INVILLE	B
IO	B
IOLEAU	C
IONA	B
IONIA	B
IOSCO	B
IOSEPA	D
IOTLA	B
IPAGE	A
IPANO	C
IPAVA	B
IPISH	C
IPSON	B
IPSWICH	D
IRA	C
IRAAN	B
IREDELL	C/D
IRELAND	C
IRENE	B
IRETEBA	B
IRIGUL	D
IRIM	C
IRMULCO	B
IROCK	C
IRON BLOSSOM	C
IRON MOUNTAIN	D
IRON RIVER	B
IRONCO	B
IRONDALE	C
IRONDYKE	B
IRONSPRINGS	B
IRONTON	C
IROQUOIS	B/D
IRRAWADDY	C
IRRIGON	C
IRSON	D
IRVINE	D
IRVINGTON	C
IRWIN	D
ISAAC	C
ISABELLA	B
ISAN	A/D
ISANTI	A/D
ISBELL	B
ISELLA	B
ISHI PISHI	C
ISHPEMING	A
ISIDOR	D
ISKHAT	C
ISKHAT, COOL	D
ISLAND	B
ISLES	D
ISLES, SLOUGH	A/D
ISLOTE	B
ISMAY	B
ISKO	C
ISOLDE	A
ISOM	B
ISTER	C
ISTOKPOGA	B/D
ITANO	C
ITASCA	B
ITAT	B
ITCA	D
ITHACA	C
ITMANN	C
ITME	A
ITSWOOT	B
IUKA	C
IVA	C
IVAN	B
IVANELL	C
IVANHOE	D
IVEP	B
IVERSEN	C
IVES	B
IVES, WET	D
IVIE	A
IVINS	C
IVYWILD	C
IXIAN	C
IYERS	D
IZAGORA	C
IZAR	D
IZEE	C
IZO	A
IZOD	D
IZUSER	B
JAPU	B
JABU, WET	C
JACAGUAS	B
JACANA	D
JACEE	C
JACINTO	B
JACK CREEK	A
JACKET	C
JACKLAND	D
JACKMAN	B
JACKNIFE	C
JACKPORT	D
JACKPOT	C
JACKS	C
JACKSON	B
JACKTONE	D
JACOB	D
JACOBSEN	D
JACOBY	C
JACOT	B
JACQUES	C
JACQUITH	C
JACRATZ	D
JACWIN	B
JADIS	B
JAFA	B
JAGUEYES	B
JAL	B
JALMAR	A
JAMES	D
JAMES CANYON	C
JAMES CANYON, DRAINED	B
JAMESTON	C/D
JANISE	C
JANISE, OVERBLOWN, DRAINED	B
JANSEN	B
JANUDE	B
JANUDE, CLAY SUBSTRATUM	C
JARAB	D
JARBOE	D
JARDIN	D
JAREALES	D
JARITA	C
JARMILLO	B
JAROLA	C
JAROSO	B
JARRE	D
JARRON	D
JARVIS	B
JASCO	D
JASON	D
JASPER	B
JAUCAS	A
JAUCAS, SALINE	C
JAURIGA	B
JAVA	B
JAWBONE	D
JAY	C
JAYAR	C
JAYBEE	D
JAYEL	D
JAYEM	B
JAYNES	D
JEAGER	C
JEAN	A
JEAN LAKE	B
JEANERETTE	D
JEBE	B
JEBO	B
JEDBURG	C
JEDD	C
JEDDITO	C
JEDDITO, SALINE-ALKALI	B
JEDDO	C/D
JEFFERS	B/D
JEFFERSON	B
JEFFREY	B
JEHEMY	D
JEKLEY	C
JELLICO	C
JEMEZ	C
JENA	B
JENKINS	C
JENKINSON	D
JENKS	B
JENNESS	B
JENNINGS	C
JENNY	D
JENOR	C
JERAG	D
JERAULD	D
JERICHO	D
JEROME	D
JERRY	C
JERRYSLU	C
JERU	B
JERVAL	B
JESNEL	D
JESSE CAMP	B
JESSIETOWN	B
JESSO	C
JESSUP	C
JETCOP	D
JETSTER	C
JETT	B
JEVETS	C
JEWETT	B
JIGGS	B
JIGSAW	C
JILSON	D
JIM	C
JIMBO	B
JIMCREEK	C
JIMEK	C
JIMENEZ	C
JIMLAKE	B
JIMMERSON	C
JIMSAGE	B
JIMTOWN	C
JIPPER	B
JIVAS	B
JOACHEM	D
JOB	C
JOBOS	C
JOSPEAK	D
JOCAL	B
JOCITY	B
JOCITY, LOAMY SURFACE	C
JOCKO	B
JODERO	B
JOEL	B
JOEMRE	B
JOENEY	D
JOES	B
JOEVAR	B
JOHNS	C
JOHNSBURG	D
JOHNSON	B
JOHNSTON	D
JOHNSTOWN	B
JOHNSWOOD	B
JOHNTON	D
JOICE	D
JOINER	B
JOKODOWSKI	D
JOLAN	C
JOLIET	D
JOLLY	C
JONALE	B
JONAS	B
JONATHAN	B
JONCA	C
JONDA	D
JONES	B
JONESVILLE	B

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Exhibit A-1, continued: Hydrologic soil groups for United States soils

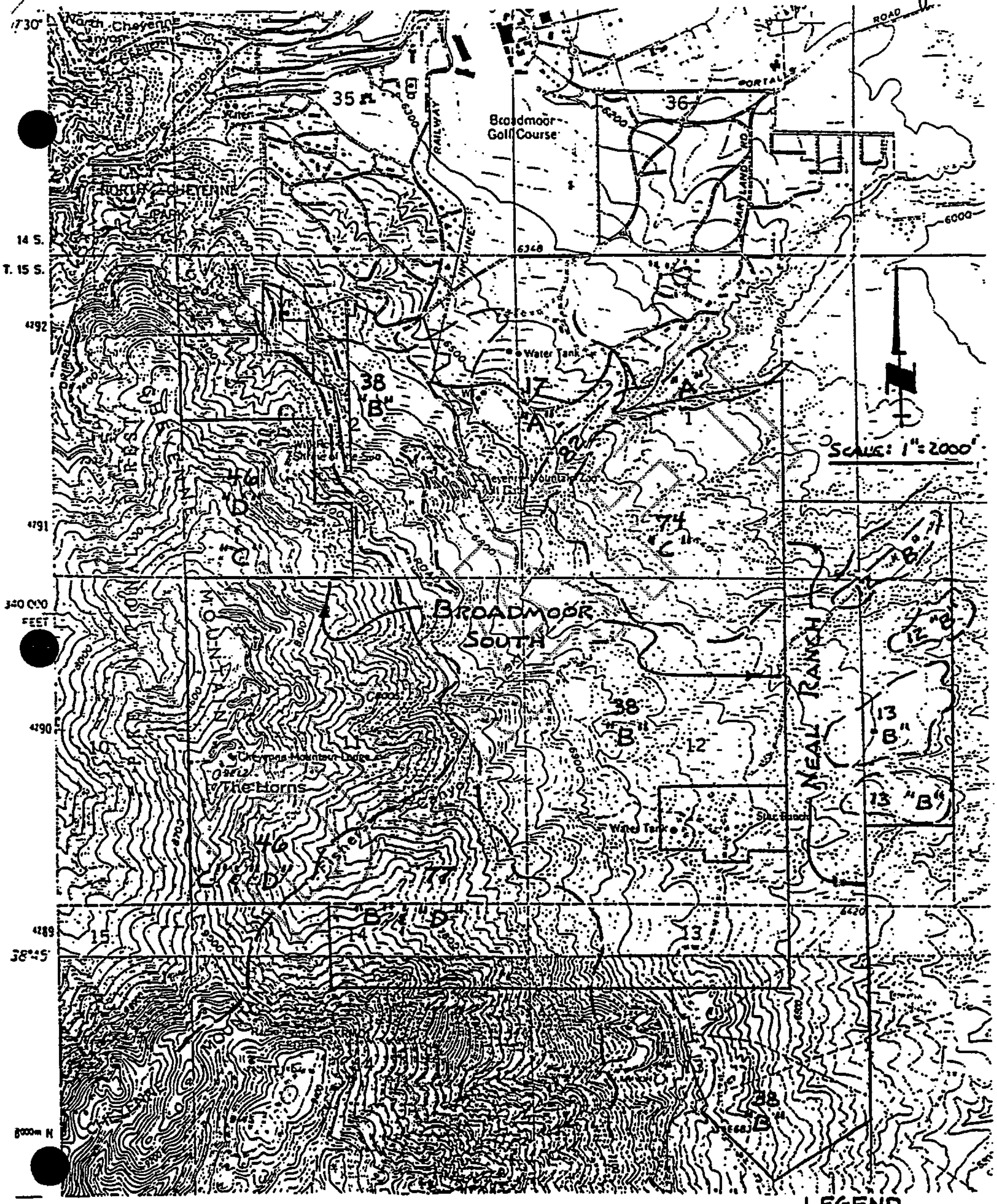
SUMYA	D	SWANTOWN	D	TACOMA	D	TANQUE	B	TEHAMA	C
SUN	D	SWANVILLE	C	TACONIC	C/D	TANSEM	B	TEHRAN	A
SUNAPEE	B	SWANWICK	D	TACOOSH	B/D	TANTALUS	B	TEIGEN	C
SUNBURG	B	SWAPPS	C	TADLOCK	B	TANTILE	C/D	TEJA	D
SUNBURST	C	SWARTSWOOD	C	TAFFON	B	TANWAX	D	TEJABE	D
SUNBURY	B	SWARTZ	D	TAFOYA	C	TANWAX, DRAINED	C	TEJANA	B
SUNCITY	D	SWASEY	D	TAFT	C	TANYARD	C	TEKENINK	B
SUNCOOK	A	SWASTIKA	C	TAFTOWN	B	TAOPI	B	TEKISON	C
SUND	C	SWAUK	D	TAFUNA	A	TAPCO	D	TEKLANIKA	A
SUNDANCE	B	SWAYNE	C	TAGGART	C	TAPIA	B	TEKOA	C
SUNDAY	A	SWEATMAN	C	TAGLAKE	B	TAPICITOES	D	TEKOA, EXTREMELY	B
SUNDELL	B	SWEDE	B	TAHKENITCH	B	TAPPAN	B/D	STONY	
SUNDOWN	A	SWEEN	C	TAHOMA	B	TARA	B	TELA	B
SUNEV	B	SWEENEY	B	TAHOULA	D	TARBORO	A	TELCHER	B
SUNFIELD	B	SWEET	C	TAHQUATS	B	TARGHEE	C	TELECAN	B
SUNLIGHT	D	SWEETAPPLE	B	TAINTOR	C/D	TARKINGTON	C	TELEFONO	C
SUNNYHAY	D	SWEETGRASS	B	TAJO	C	TARKIO	D	TELEMON	D
SUNNYSIDE	B	SWEETWATER	D	TAKEUCHI	C	TARKLIN	C	TELEPHONE	D
SUNNYVALE	C	SWEITBERG	C	TAKILMA	B	TARLOC	B	TELESCOPE	A
SUNRAY	B	SWEITING	C	TAKOTNA	B	TARNACH	D	TELFER	A
SUNRISE	C	SWEN	C	TAKPOCHAO	D	TARNAY	B	TELFERNER	D
SUNSET	B	SWENODA	B	TALAG	D	TARPLEY	D	TELL	B
SUNSHINE	C	SWIFT	B	TALAMANTES	B	TARR	A	TELLER	B
SUNSWEET	C	SWIFT CREEK	B	TALANTE	D	TARRANT	D	TELLICO	B
SUNUP	D	SWIFTON	B	TALAPUS	B	TARRETE	D	TELLMAN	B
SUNY	D	SWIMLEY	C	TALBOTT	C	TARRYALL	C	TELLURA	C
SUOMI	C	SWIMS	B	TALCO	D	TARRYTOWN	C	TELOS	C
SUP	D	SWINGLER	B	TALCOT	B/D	TASAYA	C	TELSTAD	C
SUPAN	B	SWINGLER, WET,	C	TALIHINA	D	TASCOSA	B	TEMAN	B
SUPERIOR	D	STRONGLY SALINE		TALKEETNA	B	TASSEL	D	TEMBLOR	D
SUPERSTITION	A	SWINGLER, WET	C	TALLA	C	TASSELMAN	D	TEMESCAL	D
SUPERVISOR	C	SWINK	D	TALLAC	B	TASSO	B	TEMO	C
SUPPLEE	B	SWINOMISH	C	TALLADEGA	C	TATAI	C	TEMPLE	C
SUR	C	SWINT	B	TALLAPOOSA	C	TATE	B	TEMPLETON	B
SURFSIDE	D	SWISBOR	D	TALLEYVILLE	B	TATERHEAP	B	TEMVIK	B
SURGEM	C	SWISSHELM	B	TALLOWBOX	C	TATIYEE	C	TENABO	D
SURGH	B	SWISSTAG	B	TALLS	B	TATLUM	D	TENAHA	B
SURNUF	B	SWISSVALE	D	TALLULA	B	TATOUCHE	B	TENAS	C
SURPLUS	C	SWITCHBACK	C	TALLY	B	TATTON	D	TENCEE	D
SURPRISE	B	SWITZERLAND	B	TALMAGE	B	TATUM	B	TENDOY	D
SURRENCY	D	SWOPE	C	TALMO	A	TAUNTON	C	TENERIFFE	A
SURRETT	C	SWORMVILLE	C	TALMOON	D	TAVARES	A	TENEX	B
SURVEYORS	B	SWYGERT	C	TALOKA	D	TAWAH	B	TENINO	C
SURVYA	C	SYBLON	D	TALPA	D	TAWAS	A/D	TENMILE	C
SUSANNA	C/D	SYCAMORE,	B	TALQUIN	B/D	TAWCAW	C	TENNO	D
SUSANVILLE	D	MODERATELY WET,		TALUCE	D	TAYLOR	C	TENORIO	B
SUSIE CREEK	C	SALINE		TAMA	B	TAYLOR CREEK	C	TENOT	C
SUSITNA	B	SYCAMORE,	C	TAMAHA	D	TAYLORSFLAT	B	TENPIN	D
SUSQUEHANNA	D	MODERATELY WET,		TAMALCO	D	TAYLORSFLAT,	C	TENRAG	B
SUTA	B	CLAYEY SUBSTRATUM		TAMALPAIS	C	SALINE-ALKALI		TENSAS	D
SUTCLIFF	B	SYCAMORE,	C	TAMANEEN	B	TAYLORSVILLE	C	TENSED	C
SUTHER	C	MODERATELY WET		TAMBA	D	TAZLINA	A	TENSLEEP	B
SUTHERLAND	D	SYCAMORE, DRAINED	B	TAMELY	B	TEAGULF	C	TENSNOIR	B
SUTHERLIN	C	SYCAMORE, FLOODED	C	TAMFLAT	D	TEAKEAN	B	TENVORRD	D
SUTKIN	B	SYCAMORE, CLAY	B	TAMFORD	D	TEALSON	D	TEO	B
SUTLEY	B	SUBSTRATUM		TAMMANY CREEK	B	TEALWHIT	D	TEOCULLI	B
SUTPHEN	D	SYCAN	A	TAMMING	B	TEANAWAY	B	TEPETE	D
SUTRO	C	SYCLE	B	TAMP	B	TEAPO	C	TEQUESTA	B/D
SUTTLER	B	SYCOLINE	D	TAMPICO	B	TEASDALE	B	TERADA	B
SUTTON	B	SYENITE	C	TANAMA	D	TEASPOON	D	TERBIES	B
SUVER	D	SYLACAUGA	D	TANANA	D	TEBAY	B	TERENCE	B
SUWANEE	B	SYLCO	C	TANANA, THAWED	B	TEBBS	B	TERESA	D
SVEA	B	SYLVAN	B	TANANA, MODERATELY	C	TEBO	B	TERINO	D
SVENSEN	B	SYLVANIAN	C	WET		TECHADO	D	TERLAN	D
SVERDRUP	B	SYLVESTER	B	TANASEE	B	TECHICK	B	TERLCO	B
SWAGER	C	SYLVIA	C	TANAZZA	B	TECO	B	TERLINGUA	D
SWAINOW	B	SYMCO	C	TANBARK	D	TECOLOTE	B	TERMINAL	D
SWAKANE	D	SYMERTON	B	TANDY	D	TECOMAR	D	TERMO	D
SWALER	D	SYNAREP	B	TANEUM	B	TECOPA	D	TEROMOTE	B
SWALESILVER	D	SYRACUSE	B	TANEY	C	TEDROW	B	TEROUGE	D
SWAMPYDRAW	B	SYRENE	B/D	TANGAIR	C	TEEL	B	TERRA CEIA	B/D
SWAN	D	SYRETT	C	TANGI	C	TEELER	B	TERRA CEIA, TIDAL	D
SWANBOY	D	TABECHEDING	C	TANGLE	C	TEEMAT	B	TERRA CEIA,	D
SWANDAD	B	TABERNASH	B	TANNA	D	TEESTO	D	FREQUENTLY	
SWANLAKE	B	TABLE MOUNTAIN	B	TANNAHILL	B	TEETERS	C	FLOODED	
SWANNER	D	TABLER	D	TANNER	C	TEEWINOT	D	TERRAD	C
SWANSEA	D	TABOR	D	TANNER, LOW	D	TEFTON	C	TERRETON	D
SWANSON	C	TACAN	B	PRECIPITATION		TEGURO	D	TERRETON, STONY	C
SWANTON	C/D	TACHI	D	TANOE	B	TEHACHAPI	C	TERRIL	B

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.

Exhibit A-1, continued: Hydrologic soil groups for United States soils

Soil	Group
TERRO	C
TERRY	C
TERT	D
TERWILLIGER	C
TESAJO	B
TESSFIVE	D
TETHRICK	B
TETON	C
TETONIA	B
TETONKA	C/D
TETONVIEW	D
TETONVILLE	D
TETONVILLE, GRAVELLY	C
TETOTUM	C
TEVIS	B
TEW	C
TEWA	B
TEX	B
TEXANA	D
TEXARK	D
TEXLINE	B
TEXROY	B
TEZUMA	C
THACKER	D
THACKERY	B
THADEN	C
THAGE	C
THATCHER	B
THATUNA	C
THAYNE	B
THEBES	B
THEBO	D
THEDALUND	C
THEEDLE	C
THENAS	C
THEODOR	D
THEON	D
THERESA	B
THERIOT	D
THERMO	D
THERMOPOLIS	D
THESS	B
THETFORD	A
THETIS	B
THIEFRIVER	B/D
THIEL	B
THIESSEN	C
THIKE	D
THIOKOL	B
THIRST	D
THISTLEBURN	B
THISTLEDEW	B
THOENY	D
THOMAS	B/D
THOMHILL	B
THOMS	D
THORNBURGH	B
THORNDALE	D
THORNDIKE	C/D
THORNOCK	D
THORNTON	D
THOROUGHFARE	B
THORP	C/D
THOUT	C
THOW	B
THOWSON	B
THRASH	B
THREADGILL	B
THREECHOP	B
THREEDOT	D
THREEK	C
THREEMILE	B
THREETOP	C
THROCK	C
THULUPAN	C
THU[illegible]ZRLAND	B
THUNDERBIRD	D
THUNDER	D
THURLONI	C
THURLOW	B
THURMAN	A
THURMONT	B
THWOOP	C
TIAGOS	B
TIAK	C
TIBAN	B
TIBBITTS	B
TIBS	C
TIBSON	B
TIBURONES	D
TICA	D
TICE	B
TICELL	D
TICHNOR	D
TICINO	C
TICKAPOO	D
TICKASON	B
TIDINGS	B
TIDWELL	D
TIERRA	D
TIERRANEGRE	B
TIESIDE	D
TIETON	B
TIFFANY	B/D
TIFTON	B
TIGER CREEK	B
TIGERON	B
TIGIT	C
TIGIWON	B
TIGLEY	B
TIGON	D
TIGUA	D
TIJERAS	B
TIKI	D
TILFER	B/D
TILFORD	B
TILLEDA	B
TILLICUM	B
TILLMAN	C
TILLMONT	B
TILLOU	C
TILMA	C
TILSIT	C
TILTON	C
TIMBALIER	D
TIMBERG	C
TIMBERHEAD	B
TIMBERLY	B
TIMBERVILLE	B
TIMBLIN	D
TIMBUCTOO	C
TIMENTWA	B
TIMHILL	D
TIMMUS	B
TIMKEN	C
TIMMERMAN	B
TIMMONS	B
TIMPAHUTE	C
TIMPANOGOS	B
TIMPANOGOS, MODERATELY WELL DRAINED	C
TIMPER	D
TIMULA	B
TINA	C
TINAJA	B
TINAMOU	C
TINDAHAY	B
TINDAHAY, GRAVELLY	A
TINE	A
TINEMAN	B
TINEMAN, WET	C
TINGEY	B
TINKER	C
TINN	D
TINNIN	A
TINSLEY	A
TINTON	A
TINYTOWN	B
TIOCANO	D
TIOGA	B
TIPPAH	C
TIPPECANOE	B
TIPPER	C
TIPPERARY	A
TIPPIPAH	B
TIPPO	C
TIPTON	B
TIPTONVILLE	B
TIPTOP	B
TIRO	C
TISBURY	B
TISCH	D
TISDALE	C
TISHAR	B
TISONIA	D
TISWORTH	C
TITUS	B/D
TITUSVILLE	C
TIVOLI	A
TIVY	C
TOA	B
TOADLAKE	B
TOANC	B
TOANO	B
TOBICO	A/D
TOBIN	B
TOBISH	C
TOBLER	B
TOBOSA	D
TOBY	B
TOCAL	C
TOCALOMA	C
TOCAN	B
TOCCOA	B
TOCK	C
TOCOI	B/D
TOODLER	B
TOODSTAV	D
TOODVILLE	B
TOOOS	C
TOEHEAD	B
TOEJA	B
TOEP	C
TOGCHA	B
TOGNONI	D
TOGO	B
TOGUS	D
TOHONA	C
TOIMI	C
TOINE	B
TOISNOT	B/D
TOISNOT, PONDED	D
TOIYABE	C
TOKAY	B
TOKEEN	C
TOKLAT	D
TOKOPEH	D
TOKUL	C
TOLANY	B
TOLEY	B
TOLEDO	D
TOLEX	D
TOLICHA	D
TOLKE	B
TOLL	A
TOLLGATE	B
TOLLHOUSE	D
TOLMAN	D
TOLNA	B
TOLO	B
TOLONIER	B
TOLSONA	D
TOLSONA, TILL SUBSTRATUM	B
TOLSTOI	D
TOLTEC	C
TOLUCA	B
TOLVAR	B
TOMAH	B
TOMAHAWK	A
TOMALES	D
TOMASAKI	C
TOMAST	C
TOMBAF	C
TOMBSTONE	B
TOME	B
TOMEL	D
TOMERA	C
TOMERA, CEMENTED SUBSTRATUM	D
TOMICHI	A
TOMOKA	B/D
TOMOTLEY	B/D
TOMS	C
TOMSHERRY	C
TOMTY	D
TONALEA	C
TONASKET	B
TONATA	D
TONCANA	B
TONEY	D
TONGUE RIVER	C
TONIO	B
TONKA	C/D
TONKAVAR	A
TONKAWA	A
TONKEY	B/D
TONKIN	B
TONKIN, MODERATELY WET	C
TONKS	C
TONOPAH	A
TONOP	C
TONOWEK	B
TONRA	B
TONSINA	B
TONTI	C
TONUCO	D
TOOLES	D
TOOLESBORO	B
TOONES	D
TOONF	C
TOONE, LOAMY SUBSTRATUM, STONY	B
TOP	C
TOPEKI	D
TOPEMAN	B
TOPIA	D
TOPLIFF	B
TOPONCE	C
TOPPENISH	D
TOPPENISH, DRAINED	C
TOPPER	B
TOPSEY	C
TOQUERVILLE	D
TOQUI	D
TOQUOP	A
TOR	D
TORBOY	A
TORCHLIGHT	C
TORDIA	D
TOREX	B
TORHUNTA	C
TORNEY	D
TORNILLO	B
TORNING	B
TORODA	B
TORONTO	C
TORPEDO LAKE	D
TORREON	C
TORREON, COBBLY	D
TORRES	A
TORRO	B
TORRY	B/D
TORSIDO	D
TORTUGAS	D
TORULL	D
TOSCA	B
TOSSER	B
TOSTON	C
TOTAVI	A
TOTELAKE	B
TOTEM	B
TOTIER	C
TOTO	B/D
TOTTEN	C/D
TOUCHET	C
TOUHEY	B
TOULA	C
TOULON	B
TOURN	C
TOURNQUIST	B
TOURS	B
TOUTLE	A
TOUTLE, FLOODED	B
TOVAR	C
TOWAVE	B
TOWHEE	D
TOWNER	B
TOWNLEY	C
TOWNSEND	C
TOWOSAHGY	B
TOXAWAY	B/D
TOY	D
TOYAH	B
TOYUSKA	B
TOZE	B
TRABUCO	C
TRACHUTE	B
TRACK	D
TRACK, DRAINED	C
TRACOSA	D
TRACY	B
TRADEDOLLAR	B
TRAER	B/D
TRAG	B
TRAG, COOL	C
TRAHAN	C
TRAIL	A
TRAILAMP	D
TRAILCREEK	C
TRAILHEAD	B
TRAINER	B
TRAITORS	D
TRAMPAS	C
TRAMWAY	B
TRANQUILAR	C
TRANSYLVANIA	B
TRAPPER	B
TRAPPIST	C
TRAPPS	B
TRASK	C
TRAVELERS	D
TRAVER	B
TRAVERTINE	C
TRAVESSILLA	D
TRAVIS	C
TRAVSON	D
TRAWICK	B
TRAY	C
TREADWAY	D
TREATY	B/D
TREBLE	B
TREBLOC	D
TREBOR	C
TREEKOR	D
TREEKOR, NONSTONY	C
TREEN	D
TREGO	C
TREHARNE	C
TRELK	B
TRELONA	D
TREMANT	B

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION.
MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.



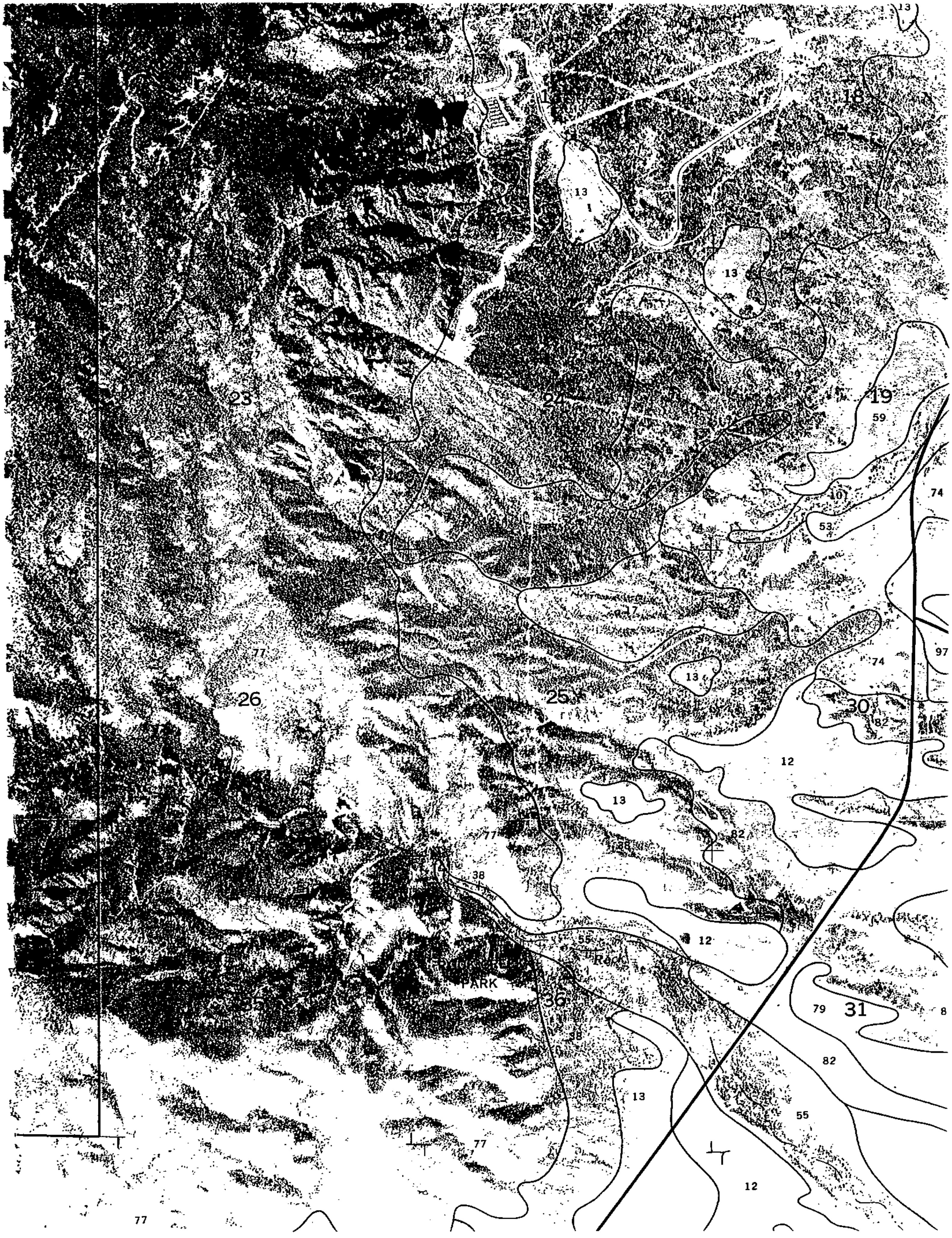
LEGEND

SCS MAP SYMBOL — 38

HYDROLOGIC CLASS — "B"

ASSUMED

FIGURE II – SOILS CLASSIFICATION MAP



18
13
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97
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26
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82
12
13
77
82
38
55
12
PARK
36
79
31
38
82
13
55
77
12
77


MESA RESERVOIR
water
Broadmoor
BIG STRATTON RESERVOIR
ORTH CHEYENNE
CANYON
Cheyenne Creek
CANYON
Creek
Cheyenne
Creek
27
26
25
30
34
35
36
31
1
6
7

Subject Boulder Broadmoor - Cross Sections HEC1 Routing

Project No. 24506

Task No. 001

File No.

Sheet 1/2

By SGD

Checked By SWR

Date 12/1/97

Date 12/27/97

OBJECTIVE: Develop cross section for routed basins

GIVEN: Site topo (1:2400)

A-A

LOB n	- 0.12		
ROB n	- 0.12		
Channel n	- 0.08		
EL_0	- 7100'		Routed 1B & 1C thru 1D
EL_1	- 6760'		
L_{chan}	- 1600'		
S_B	- 0.21		

B-B

LOB n	- 0.12		
ROB n	- 0.12		
Channel n	- 0.08		
EL_0	- 6900'		Routed 1A thru 1D
EL_1	- 6800'		
L_{chan}	- 700		
S_B	- 0.14		

C-C

LOB n	- 0.12		
ROB n	- 0.12		
Channel n	- 0.08		
EL_0	- 6790'		Routed 1A-1D thru A
EL_1	- 6480'		
L_{chan}	- 4000'		
S_B	- 0.08		

Woodward-Clyde

Subject Boulders Broadmoor - Cross Sections
Hec-1 Routing

Project No. [illegible]

Task No. 001

By SRS

Checked By

File No.

Date 12/2/97

Date

Sheet 2/2

D-D

LOB n	- 0.12	
ROB n	- 0.12	
Channel n	- 0.08	
EL_0	- 6760'	Routing 2 thru C
EL_1	- 6330'	
L_{chan}	- 6400'	
S_{RB}	- 0.07	

E-E

LOB n	- 0.12	
ROB n	- 0.12	
Channel n	- 0.08	
EL_0	- 6690'	Routing 3 thru A
EL_1	- 6500'	
L_{chan}	- 7200'	
S_{RB}	- 0.03	

F-F

LOB n	- 0.12	
ROB n	- 0.12	
Channel n	- 0.08	
EL_0	- 6650'	Routing 4 thru 14
EL_1	- 6500'	
L_{chan}	- 2800'	
S_{RB}	- 0.05	

Subject Boulders Broadmoor | Project No. 24506

By SED | Checked By SWR | Task No. 001

File No.

Date 11/18/97 | Date 12/28/97 | Sheet 1/2

OBJECTIVE:

ESTIMATE CAPACITIES OF EXISTING AND PROPOSED CULVERTS WITHIN BOULDERS BROADMOOR COMMUNITY MDDP AREA

GIVEN:

REVIEW OF EXISTING 1"=2400 TOPO & REPORTS

SOLUTION:

FOR PURPOSES OF THIS ANALYSIS, AND GIVEN LOCATIONS OF CULVERTS, IT WAS ASSUMED THAT CULVERTS ARE INLET CONTROLLED (WHERE CULVERTS HAVE SLOPE > 1%)

GOVERNING DISCHARGE EQUATION:

$$Q = C_d A \sqrt{2gh}$$

w/ Q = DISCHARGE (CFS)

C_d = COEF. OF DISCHARGE

A = FLOW AREA (FT^2)

g = 32.2 F/S^2

h = HEAD @ INLET (FT)

Subject: Boulders Broadmoor MDDP - Curve Numbers | Project No. 24506

By: GCS | Checked By: SWR | Task No. 001

File No.

Date: 12/1/97 | Date: 12/27/97 | Sheet: 1

OBJECTIVE:

Estimate curve numbers for identified basins

GIVEN:

Site map w/ basin characteristics

SOLUTIONS

Basin ID	Basin Area (mi^2)	Soil Group	Curve Number	
1A	0.023	B	78	Above Flood Pool
1B	0.231	↓	78	
1C	0.037	↓	78	
1D	0.050	↓	78	
2	0.043	↓	78	
3	0.687	↓	78	
4	0.096	↓	78	
A	0.091	B	58	Boulders Broadmoor Comm'y (Undeveloped)
B	0.018	↓	58	
C	0.088	↓	58	
D	0.023	↓	58	
E	0.010	↓	58	
F	0.009	↓	58	
G	0.034	↓	58	
H	0.030	↓	58	
A	"	"	72	Boulders Broadmoor Comm'y (Developed)
B	↓	↓	72	
C	↓	↓	72	
D	↓	↓	72	
E	↓	↓	72	
F	↓	↓	72	
G	↓	↓	72	
H	"	"	72	

Table 2-2d.—Runoff curve numbers for arid and semiarid rangelands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Elbeth:					
[1]27:					
Pring part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ellicott:					
28	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Fluvaquentic Haplaquolls:					
29	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Fort Collins:					
30	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell, frost action.
31	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Moderate: low strength, shrink-swell, frost action.
Fortwingate:					
[1]32:					
Fortwingate part	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope, low strength.
Rock outcrop part.					
Heldt:					
33	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Holderness:					
34, 35	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
36	Moderate: too clayey, slope.	Severe: shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Jarre:					
37	Slight	Moderate: shrink-swell, low strength.	Slight	Moderate: slope, shrink-swell, low strength.	Moderate: frost action, shrink-swell, low strength.
[1]38:					
Jarre part	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope.	Severe: slope.	Moderate: slope, shrink-swell, low strength.
Tecolote part	Severe: slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roa and stree
Razor:					
74	Moderate: too clayey, large stones.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swel low strengt
[1]75:					
Razor part	Moderate: depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swel low strengt
Midway part	Severe: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swel low strengt
Rizozo:					
[1]76:					
Rizozo part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to ro
Neville part	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: frost actio
Rock outcrop:					
[1]77:					
Rock outcrop part.					
Coldcreek part	Severe: slope, small stones, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tolman part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to ro
Sampson:					
78	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strengt frost actio shrink-swel
Satanta:					
79, 80	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swel low strengt
[1]81:					
Satanta part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swel low strengt
Neville part	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: frost actio
Schamber:					
[1]82:					
Schamber part	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Razor part	Moderate: depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swel low strengt

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT

"Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
lamosa:						
1	Seepage, excess humus.	Low strength, compressible, piping.	Slope, floods, poor outlets.	Slope, wetness, floods.	Wetness, piping.	Wetness.
scalon:						
2	Seepage, slope.	Piping, low strength.	Slope	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
3	Seepage, slope.	Piping, low strength.	Slope	Slope, erodes easily.	Erodes easily, piping, slope.	Erodes easily, slope.
Badland:						
4.						
ijou:						
5, 6, 7	Seepage, slope.	Piping	Slope	Slope, droughty, erodes easily.	Erodes easily, piping.	Erodes easily, droughty.
lakeland:						
8	Seepage, slope.	Piping	Slope	Erodes easily, slope, droughty.	Erodes easily, piping.	Slope, erodes easily, droughty.
[1]9:						
Blakeland part	Seepage, slope.	Piping	Slope	Erodes easily, slope, droughty.	Erodes easily, piping.	Slope, erodes easily, droughty.
Fluvaquentic Haplaquolls part	---	---	Wetness	Wetness	Wetness	Wetness.
lendon:						
10	Seepage	Seepage, piping.	Not needed	Seepage	Not needed	Favorable.
resser:						
11	Seepage	Piping	Slope	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
12	Seepage, slope.	Piping	Slope	Slope, erodes easily.	Erodes easily, piping.	Slope, erodes easily.
13	Seepage, slope.	Piping	Slope	Slope, erodes easily.	Slope, erodes easily, piping.	Slope, erodes easily.
russett:						
14	Slope, seepage.	Low strength, hard to pack, piping.	Slope	Slope	Piping	Favorable.
15	Slope, seepage.	Low strength, hard to pack, piping.	Slope	Slope	Piping	Slope.
haseville:						
16	Seepage, slope.	Erodes easily, piping, seepage.	Cutbanks cave	Slope, droughty.	Erodes easily, piping.	Slope, erodes easily, droughty.
17	Seepage, slope.	Erodes easily, piping, seepage.	Slope, cutbanks cave.	Slope, droughty.	Slope, erodes easily, piping.	Slope, erodes easily, droughty.

See footnote at end of table.

Exhibit A-1, continued: Hydrologic soil groups for United States soils

BOLFAR	C
BOLICKER	B
BOLING	D
BOLIVAR	B
BOLLINGS	C
BOLSA	C
BOLTON	B
BOLTUS	D
BOMBAY	C
BOMBOIS	D
[illegible]	B
BOMOSEEN	C
BON	B
BONAIR	D
BONANZA	B
BONAPARTE	A
BONCLAIR	B
BOND	D
BONDFARM	D
BONDMAN	D
BONDRANCH	D
BONDUEL	C
BONE	D
BONEEK	B
BONEYARD	C
BONFIELD	B
[illegible]	C
BONIS	A
BONHAM	C
BONIFAY	A
BONILLA	B
BONITA	D
BONJEA	D
BONK	D
BONNEAU	A
BONNELL	C
BONNER	B
BONNERDALE	B
BONNET	B
BONNEVILLE	A
BONNICK	A
BONNIE	C/D
BONNIE, PONDED	C
BONNYDOON	D
BONO	D
BONSALL	D
BONTA	B
BONTI	C
BONWIER	C
BONWIER, GRADED	D
BONZ	C
BOOFORD	C
BOOFUSS	D
BOOKCLIFF	B
BOOKER	D
BOOKOUT	C
BOOKWOOD	B
BOOMER	B
BOONSTICK	D
BOONTOWN	D
BOONE	A
BOONESBORO	B
BOONEVILLE	B
BOONTON	C
BOONVILLE	C
BOONVILLE	D
BOOTH	C
BOOTHBAY	C
BOOTJACK	D
BOOTS	A/D
BOQUILLAS	C
BORACHO	C
BORAH	C
BORAVALL	D
BORDA	D
BORDEAUX	B
BORDEN	B
BORDER	B
BOREALIS	D
BORGEAU	B
BORGES	D
BORIANA	D
BORKY	C
BORNSTEDT	C
BORO	D
BOROBEY	C
BORREGO	D
BORREGUERO	C
BORSKI	B
BORTH	C
BORUP	B/D
BORVANT	D
BOSANKO	D
BOSCO	B
BOSKET	B
BOSLER	B
BOSO	D
BOSQUE	B
BOSSBURG	D
BOSSBURG, DRAINED	C
BOSTON	C
BOSTRUM	D
BOSTWICK	B
BOSVILLE	C
BOSWELL	D
BOSWORTH	D
BOTELLA	B
BOTHWELL	B
BOTHWI	C
BOTON	B
BOTTINEAU	C
BOTTLE	C
BOTTLEROCK	C
BOULDER	B
BOULDER LAKE	D
BOULDER POINT	B
BOULDERCREEK	B
BOULDIN	B
BOULFLAT	C
BOUNCER	D
BOUNDARY	B
BOURBON	B
BOURNE	C
BOUSIC	D
BOW	D
BOWBAC	C
BOWBELLS	B
BOWDISH	C
BOWDLE	B
BOWDOIN	D
BOWDRE	C
BOWEN	C
BOWERS	C
BOWES	B
BOWIE	B
BOWLAKE	C
BOWLUS	B
BOWMAN	C
BOWMANSVILLE	B/D
BOWNS	C
BOWSTRING	A/D
BOXELDER	C
BOXFORD	C
BOXVILLE	C
BOXWELL	C
BOY	B
BOYCE	D
BOYD	D
BOYER	B
BOYETT	B
BOYKIN	B
BOYLE	D
BOYSAG	D
BOYSEN	D
BOZE	B
BOZEMAN	B
BRABAS	D
BRACE	C
BRACEVILLE	C
BRACKEN	B
BRACKETT	C
BRAD	D
BRADDOCK	B
BRADEN	B
BRADENTON	B/D
BRADENTON, FLOODED	D
BRADER	D
BRADSHAW	B
BRADSON	B
BRADWAY	D
BRADY	B
BRADYVILLE	C
BRAFFITS	B
BRAGG	C
BRAHAM	B
BRAILSFORD	C
BRAINERD	C
BRALLIER	D
BRAM	C
BRAMARD	B
BRAMLETT	C
BRAMWELL	C
BRANCH	B
BRANCROFT	C
BRANO	D
BRANDENBURG	A
BRANDON	B
BRANDYWINE	C
BRANFORD	B
BRANHAM	C
BRANSCOMB	B
BRANTFORD	B
BRANTLEY	C
BRANYON	D
BRASHEAR	C
BRASSFIELD	B
BRATTON	B
BRAUN	C
BRAVANE	D
BRAWLEY	D
BRAXTON	C
BRAY	D
BRAYTON	C
BRAZILTON	D
BRAZITO	A
BRAZITO, THICK SURFACE	B
BRAZITO, THICK SURFACE, SALINE-ALKALI	C
BRAZON	C
BRAZORIA	D
BRECKENRIDGE	B/D
BRECKNOCK	B
BRECKSVILLE	C
BREECE	B
BREGAR	D
BREIEN	B
BREKO	B
BREMER	C
BREMER, SANDY SUBSTRATUM	B
BREMO	C
BREMS	A
BRENDA	C
BRENHAM	C
BRENNAN	B
BRENNER	D
BRENT	D
BRENTON	B
BRENTSVILLE	C
BRENTWOOD	B
BRESSA	C
BRESSER	B
BREVARD	B
BREVATOR	C
BREVORT	B/D
BREW	C
BREWER	C
BREWLESS	C
BREWSTER	D
BREWTON	C
BRIBUTTE	D
BRICKEL	C
BRICKMILL	C
BRICKTON	C
BRICO	C
BRIDGE	C
BRIDGECREEK	C
BRIDGEHAMPTON	B
BRIDGEPORT	B
BRIDGER	B
BRIDGESON	D
BRIDGESON, DRAINED	C
BRIDGET	B
BRIDGEWATER	B
BRIEDWELL	B
BRIEF	B
BRIER	D
BRIGGS	A
BRIGGSDALE	C
BRIGGSVILLE	C
BRIGHTON	B/D
BRIGHTWOOD	B
BRILEY	B
BRILL	B
BRILLIANT	B
BRIMFIELD	C/D
BRIMLEY	B
BRIMSTONE	D
BRINEGAR	B
BRINGHEE	B
BRINKER	C
BRINKERT	C
BRINKERTON	D
BRINNUM	D
BRINNUM, DRAINED	C
BRIONES	B
BRIOS	A
BRISBANE	B
BRISCO	B
BRISCOT	D
BRISCOT, DRAINED	C
BRISKY	D
BRISTOW	D
BRITTO	D
BRITTON	D
BRITWATER	B
BROAD	C
BROAD CANYON	B
BROADALBIN	C
BROADAX	B
BROADBROOK	C
BROADHEAD	C
BROADHURST	D
BROADMOOR	C
BROADUS	B
BROADWELL	B
BROBETT	C
BROCK	D
BROCKET	C
BROCKGULCH	C
BROCKLISS	B
BROCKMAN	C
BROCKO	B
BROCKPORT	D
BROCKROAD	C
BROCKSBURG	B
BROCKTON	D
BROCKWAY	B
BROCKWELL	B
BRODALE	C
BRODY	C
BROE	B
BROGAN	B
BROGDON	B
BROKENHORN	D
BROLLIAR	D
BROMER	C
BROMIDE	B
BROMO	B
BRONAUGH	B
BRONCHO	B
BRONCHO, LOAMY SUBSTRATUM	A
BRONELL	B
BRONSON	B
BRONTE	C
BROOKE	D
BROOKFIELD	B
BROOKINGS	B
BROOKLYN	C/D
BROOKMAN	D
BROOKSHIRE	C
BROOKSIDE	C
BROOKSTON	B/D
BROOKSTON, STONY	D
BROOKSVILLE	D
BROOME	B
BROPHY	A/D
BROSE	D
BROSELEY	B
BROSS	B
BROUGHTON	D
BROWARD	C
BROWER	B
BROWNBEAR	C
BROWNDELL	D
BROWNELL	B
BROWNFIELD	A
BROWNLEE	B
BROWNRIGG	D
BROWNSCOMBE	C
BROWNSCREEK	B
BROWNSDALE	C
BROWNSTO	B
BROWNSVILLE	C
BROWNTON	C/D
BROXON	B
BROYLES	B
BRUBECK	D
BRUCE	B/D
BRUELLA	B
BRUELLA, HARD SUBSTRATUM	C
BRUFFY	B
BRUHEL	B
BRUIN	B
BRUMAN	B
BRUMBAUGH	C
BRUNCAN	D
BRUNDAGE	D
BRUNEEL	D
BRUNELDA	D
BRUNO	A
BRUNSWICK	B
BRUNZELL	B
BRUSHCREEK	C
BRUSHCREEK	B
BRUSSELS	C
BRUSSETT	B
BRYAN	A
BRYANT	B
BRYARLY	D
BRYCAN	B
BRYCE	D
BRYMAN	B
BRYSTAL	B
BUB	C
BUBUS	B
BUCAN	C
BUCAN, GRAVELLY	D
BUCHANAN	C
BUCHEL	D
BUCHENAU	C

NOTES: TWO HYDROLOGIC SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION. MODIFIERS SHOWN, E.G., BEDROCK SUBSTRATUM, REFER TO A SPECIFIC SOIL SERIES PHASE FOUND IN SOIL MAP LEGEND.