A Numerical Ground-Water Model for the Island of Lana'i, Hawaii

Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii

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EXECUTIVE SUMMARY

This numerical ground-water model for the Island of Lana'i has multiple objectives, purposes, and goals beyond the standard attempt to simulate historically observed data, create a predictive tool, and ultimately provide a firmer understanding Lana'i's ground-water hydrology. This study additionally attempts to provide a common-ground framework of required reporting contents for future modelling efforts in Hawaii within which hydrologists can explain and critique each others analyses and findings of numerical ground-water models.

The entire record of measured geologic and hydrologic information is presented in this report from which the conceptual model of Lana'i is derived along with the calibration targets of early Maunalei Tunnel flows and the chronological order of initial water-levels in shafts and wells. A major assumption in the conceptual model is geologic homogeneity and isotropy on the regional scale.

Lana'i is a small island (140 miles^2) with only one significant stream, Maunalei Gulch, which lies in the rain shadow of the islands of Maui and Molokai yet it has ground-water-levels which range from the a few feet near the coast to over 1500 ft. above mean sea level (msl) near the central portion of the island. This is generally the result of impediments to ground-water flow in the major rift zones of the island under areas of significant recharge. Of all the Hawaiian islands, Lana'i relies the most on high-level ground-water where water-level elevations of wells with utility range between 600 to 1500 ft. above msl. Using a geographic information system (GIS) to model recharge on a monthly basis while recognizing soil-moisture considerations resulted in an annual average recharge of 61.60 million gallons per day (mgd).

The calibration effort on steady-state and transient water-level analysis show that the numerical model can reasonably simulate regional water-levels. Also, the effort revealed that the extent of the high-level aquifer could be larger than previously estimated and that recharge appears to be augmented by something more than observed rainfall; most likely fog-drip. Although steady-state calibration targets were simulated adequately, transient simulation of historical water-levels revealed that no one regionally homogenous storage coefficient could be identified. This fact undermines the major conceptual model assumption of regional homogeneity and isotropy but does not invalidate the regional utility of the model.

Six predictive scenarios were investigated and their results are summarized as follows:

Scenario	Description	Results
1	'42 to '94 Average Pumpage = 1.79 mgd	Water-level response is between 20% to 95% complete (several decades to several centuries to go). Upper Maunalei tunnel should cease flowing.
2	Fog-drip Removal (8.9 mgd)	Water-level response would take several centuries with decreases between 100 to 700 ft. depending on well location. Both Maunalei tunnels would cease to flow.
3	Total pumpage = 6 mgd with existing well infrastructure	Shaft 2 may lose its present utility without any modifications to other existing wells and both Maunalei tunnels would cease to flow. Existing wells would need to be deepened, and/or additional wells would need to be drilled, and pumping schedules carefully managed.
4	Combining 1 & 2	Many existing wells will lose their utility as well water-levels decline to sea-level.
5	Palawai Caldera Pumpage = 0.650 mgd	Impacts to upgradient potable sources are small and may be immeasurable.
6	Future Pumpage = 3.52 mgd	Aquifer is not harmed under this scenario. Existing wells may need some modification as some wells have no track record for this average pumpage. No well water-level declines to sea level are expected. Lower Maunalei tunnel should continue to flow at around 0.103 mgd (i.e.total developed water = 3.62 mgd).

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Introduction

Objectives, Purpose, and Goals

The impetus which generated this study for Lana'i was a request by the Land Use Commission (LUC), State of Hawaii, for Lanai Co. (LCo.), in conjunction with the Commission on Water Resource (CWRM), State of Hawaii, and the U.S. Geological Survey (USGS), to produce a numerical model to further assess the ground-water hydrology of the island and potential impacts of pumping ground-water from Lanai's high-level aquifer. No specific objectives were outlined by the LUC other than to produce a numerical ground-water model.

As such, the objectives, purpose, and goals for this study were kept simple and are as follows:

(1) To provide a firmer understanding of Lanai's ground-water flow system based on the more detailed level of analysis required by a numerical model.

(2) To provide a firmer understanding of the limitations of the existing well configuration as far as developing and utilizing the ground-water flow system.

(3) Produce a two-dimensional (2D) preliminary numerical flow-type model to investigate ground-water heads and flows only, rather than a transport-type model which additionally incorporates solute transport phenomena. Solute transport is not of primary concern at this time. Additionally, the numerical code should have three-dimensional (3D) capabilities;

(4) The model shall be at least interpretive and possibly predictive. As described by Anderson & Woessner (1992), a model at the interpretive level of investigation requires the methodology and framework for organizing existing data and formulating ideas about the ground-water system dynamics, while predictive models require a greater level of detail and calibration to reproduce actual observed data and responses to pumping. This approach may also be classified as the solution to an identification or "inverse" type problem (Anderson, & others, 1992; Weeks, 1994). Inverse type problems are where stresses, like pumpage, and the resulting responses, or resulting water-levels, are known, but the aquifer system itself is unknown;

(6) To provide a framework of model reporting requirements for future studies related to ground-water numerical modelling efforts in Hawaii.

(5) Lastly, this study provides an opportunity for hydrologists from LCo. and government agencies to work together to produce a useful and meaningful numerical ground-water model to further the geohydrologic knowledge of the island, to provide an additional water management tool for the CWRM, and to give the community of the Lana'i a greater sense of confidence in the estimates for the occurrence and availability of ground-water on Lana'i.

General Regional Setting

The Island of Lana'i is a single volcanic shield which has been extinct the longer than any of the other main Hawaiian islands (Stearns, 1946). Information regarding Lanai's general regional setting are shown in Figure 1.

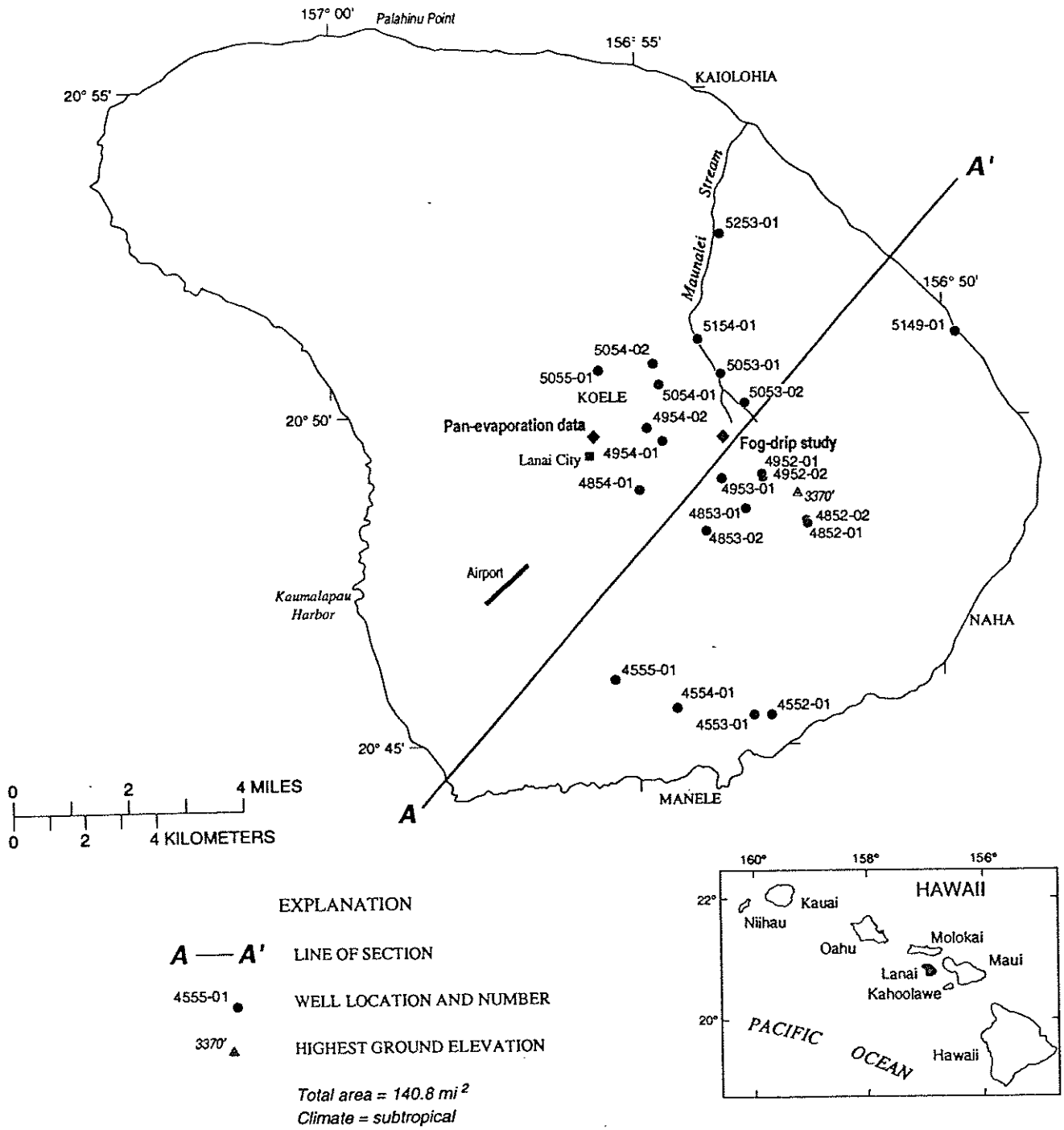


Figure 1. General Regional Setting of Lana'i

Previous Studies

There have been many studies directly concerning the geology, hydrology, land use, and water resource development of Lana'i which are helpful for producing a ground-water numerical model for Lana'i. These studies are chronologically ordered and a brief description of each is found in Table 1. Full reference of these studies is located in the reference section of this report.

Table 1. Previous Hydrologic Studies on Lana'i

Year	Author	Investigated - selected major conclusions
1922	Munro, G.C.	**Fog-drip observations.**
1924	Palmer, H.S.	**Ground-water conditions** - no high-level aquifers.
1925	Wentworth, C.K.	**Geologic conditions** - no high-level aquifers.
1926	Munro, J. T.	**Fog-drip observations.**
1930	Clark, W.O.	**Ground-water development** - no high-level aquifer but recommended tunneling in Maunalei Gulch.
1938	Steams, H.T.	**Ancient shorelines** - similar ocean stands experienced as the island of Oahu.
1940	Swartz, J.W.	**Geophysical resistivity survey** - profile depth to salt-water/ freshwater interface along transect from Kaumalapau Harbor to the mouth of Maunalei Gulch interpreted as no high-level.
1940	Macdonald, G.A.	**Petrography** - island building volcanics ceased at primitive stage; shield building & caldera filling
1940	Steams, H.T.	**Geology & Ground-Water** -est. recharge 6.46 mgd for high-level aquifer; 21.26 mgd for island.
1946	Steams, H.T.	**Short synopsis of Lanai's general geologic history.**
1953	Steams, H.T.	**Supplement Ground - Water Development on Lana'i** - sustainable yield 3 mgd or more. Ground- water loss is heavy on windward side between Maunalei and Lopa and not recovered presently.
1954	Munro, J.T. & others	unpublished Company internal hydrological analyses (Mink, 1983).
1957-59	Anderson, K.E.	Three reports cited by Steams (1959) but not found in research. Defined 'Safe Yield' = 1.9 mgd.
1959	HI Water Authority	Water Resources in the State - Development of Lana'i groundwater and fog-drip importance.
1959	Steams, H.T.	**Safe Yield** - "Safe Yield" described by Anderson (1957-59) is defined by well infrastructure and yield may be increased by adding more wells. Believes little lateral leakance between wells.
1959	Anderson, K.E.	**"Safe Yield" definition letter** - concurred with Steams's definition of "safe yield" and that it can be increased through development of new sources & lateral leakance phenomena.
1960	Anderson, K.E.	2 Water supply reports: Safe yield from sources = 2.2 mgd.
1961	Anderson, K.E.	**3 Water supply reports - Safe Yield from sources increased to 2.3 mgd. Ultimate high-level aquifer supply** estimated at 3.6 to 4.8 mgd. Appreciable amounts of Maunalei tunnel water flows by pass water supply system, are not accounted, and probably flow into the sea.
1964	Ekern, P.C.	**Fog-drip** - rainfall precipitation augmented by 30 inches/yr beneath a mature Norfolk pine.
1965	Malahoff, A., & others	**Geophysical magnetic survey** - verified Steam's rift zones and additional deep rifts.
1965	Krivoy, H.L.	**Geophysical gravity survey** - verified that main caldera located within Palawai basin.
1967	Sahara, T.S. & others	**Land classification** - various land use, soil, vegetation, crop productivity, acreage data.

Table 1. Previous Hydrologic Studies on Lana'i (Continued)

Year	Author	Investigated - selected major conclusions
1968	Ching,A.Y. & others	**Land productivity rating** - various agricultural ratings and irrigated acres.
1971	Bowles, S.P.	unpublished watershed conservation and management program report (Bowles, 1974).
1972	Foote, D, & others	**Soil Classifications** - island-wide identification and classification of soil information.
1973	Adams, W.M. & others	**Geophysical resistivity** - optimum drilling sites for high-quality basal water in southeast area between Lopa and Naha. Lower quality between Kaiolohia and Lopa.
1973	Armstrong & others	**Regional hydrologic parameter** - average annual runoff = 11 in./yr rainfall = 21 in./yr.
1974	Bowles, S.P.	**High-level aquifer development plan** - infiltration (recharge) estimated at 6.5 mgd.
1975	Lloyd, R.H.	**Description of wells, tunnels, and hydrology** - Tunnels began work in 1923.
1979	USWRC	**Regional hydrologic parameters** - Total recoverable ground-water (i.e. sustainable yield) = 5 mgd, developed (as of 1975) = 3 mgd, high-level area possibly larger than previously believed.
1982	Schoeder, T.A.	**Rainfall** - median rainfall isohyets.
1983	Anderson, K.E.	**Water supply review**: for planning purposes island freshwater supply estimate is 4.1 to 5.5 mgd Correction to reported Well 3 data by -111 ft. from 4/79 to XI/83.
1983	Mink, J.F.	**High-level potable supply** - recharge est. 9.3 mgd, sustainable yield est. 6 mgd.
1984	Anderson, K.E.	**Letter report on Mink's hydrologic analysis**- disagreed with Mink's approach.
1984	Anderson, K.E.	**Water supply review** - wells and infrastructure capable of supplying 2.7 mgd
1985	Giambelluca, T.W.	**Rainfall** - median and mean rainfall isohyets.
1985	Anderson, K.E.	**Water supply review** -wells and infrastructure capable of supplying 2.6 mgd.
1986	Harding Lawson, Ass.	**Electrical resistivity investigation** - emphasis on locating productive fresh water areas.
1988	Ekern, P.C.	**Evaporation rates** - only one evaporation pan on Lana'i, insufficient to make isogram.
1989	Anderson, K.E.	**Memo update on high-level water supply** - recharge = 8.89 mgd, S.Y. = 6.22 mgd.
1989	M&E Pacific, Inc.	**Water resources development plan** - Koele and Manele project water demands/development.
1989	JMM, Inc.	**Lanai Water Use (1948-1988)** - Graphs of ground-water use and water-levels.
1990	CWRM	**Water management area petition** - Lana'i not designated but determined that reasonable hydrologic values are: Recharge = 9 mgd, Sustainable Yield = 6 mgd, and identified a CWRM limit on ground-water use = 4.3 mgd.
1991	Giambelluca, T.W.	**Drought** - Lanai's most severe occurred in 1931 and lasted 9 months.
1993	Mink, J.F.	**Aquifer identification and Classification for Lana'i** - aquifer boundaries for protection strategy.
1993	Hobdy, R.	**Forest Reduction** - Feral herbivores are responsible for most of forest damage/recharge impact.
1994	CEES-BGD	TDEM surveys - Areal extent of possible high-level.

A few other hydrologic investigations are not listed in Table 1 because the results have not been formerly published and no permission from the author to mention them was obtained. Well information has been verified by an independent monitor and confirmed by the Lanai Water Committee. Additionally, environmental assessments (EAs) for the Koele and Manele project districts were made for Lana'i and contain much of the hydrologic information found in M&E Pacific, Inc.'s (1989) water resources development plan.

Hydrologic Setting and Conceptual Model

A conceptual model includes the essential features that represent a physical system. It is based on the physical framework observed, which in this case is the geohydrologic conditions on Lana'i, and attempts to link this observed physical framework to an equivalent digital framework in a numerical model. The geohydrologic framework of Lana'i upon which the conceptual model is based is described in the following subsections

General Aquifer Characteristics

Lana'i has basal and high-level dike confined aquifers. Our knowledge of actual areal extent of these aquifers is limited by the amount of well and borehole information to date, but a typical conceptual profile of the high-level and basal aquifers for Lana'i is shown in Figure 2. Due to the information gathered from Well 10 the high-level aquifer is now believed to cover more than 15 square miles. The high-level aquifer has both potable and brackish water. The potable water is of very good quality which is typical of high-level aquifers. High-level *brackish* water (Cl^->300 mg/l) has only been found in wells located within the Palawai basin area and are accompanied by geothermal heating. Basal water is only brackish as evidenced by wells found both near the coast and over a mile inland at Shaft 1.

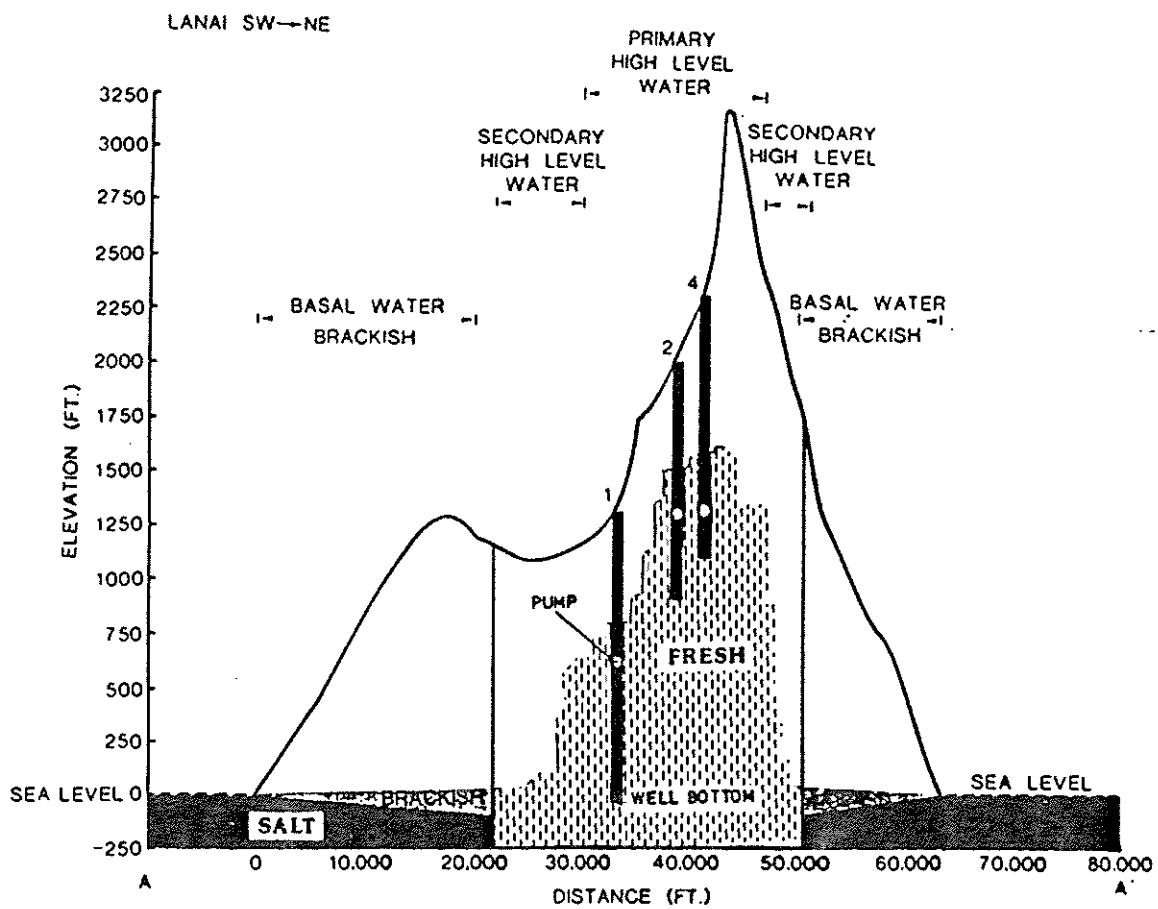


Figure 2. Profile of Basal and High-Level Aquifers on Lana'i (Mink, 1983)

Conceptual Hydrologic Boundaries

The conceptual hydrologic boundaries consist of *physical* or *hydraulic* boundaries which define the entire ground-water domain and will internally influence ground-water flow patterns. Basically, Lanai's major hydrologic boundaries consist of the Pacific Ocean which surrounds and penetrates under the entire island of Lana'i, caprock-like beach rock along the north shore of the island, three (3) major rift zones which are manifested by observed dike and fault boundaries, and the unconfined water table.

The salt-water of the Pacific Ocean effectively acts as a physical boundary surrounding, underlying, and constraining fresh ground-water flow for Lana'i. Freshwater in basal aquifers is known to float on top of the denser salt-water to form a freshwater lens according to the Gyhben-Herzberg relationship (DuCommon, 1828; Ghyben, 1889; and Herzberg, 1901). The location of streamlines along the bottom of the lens effectively makes a hydraulic boundary between fresh and salt water. Through geophysical resistivity analysis of a cross-section of the island consisting of twenty-one (21) readings between Kaumalapau Harbor to the mouth Maunalei Gulch (near Lae Hi Point), Swatrz (1940) recorded a maximum thickness of the freshwater lens to be 973 ft. at Station 11, where the maximum depth below mean sea level (msl) to salt water is 948 ft. with a corresponding calculated water table elevation of 23.7 feet above msl (see Figure 3, pg. 7). However, initial water-levels found at three (3) wells located within approximately one mile of Swartz's Station 11, Wells 6 & 7 and Shaft 2, encountered water-levels much higher than expected; 1005, 650, and 735 feet above sea level, respectively. Also, only Wells 1, 9, & 10 have been drilled below sea level in the high-level aquifer but none of these wells have encountered a transition zone or confining bottom under the dike confined portion of the aquifer. A later electrical resistivity study by Harding Lawson Assoc. (HLA, 1986) consisted of thirty-three (33) stations strung out roughly perpendicular to Swartz's study along the central part of Lana'i (see Figure 3, pg. 7) also resulted in shallow fresh water layers. In some instances, the interpretations by HLA show an absence of high-level freshwater between wells which have encountered and produced potable high-level ground-water. In fact, the HLA study is careful to point out that their interpretations may be erroneous due to the presence of the lateral boundaries of dikes and faults. Other resistivity methodologies can be used to quantify the depth to salt water, the most recent effort performed by CEEG-BGD (1994) using the Time Domain Electromagnetic (TDEM) surveys (not available during the time of model calibration). Approximately ninety-nine (99) soundings were taken around the island to estimate the depth to the salt water/fresh water interface and high-level ground-water occurrence (see Figure 4, pg. 8). This areal extent was postulated as early as 1979 (USWRC, 1979). The maximum salt water freshwater interface depth below msl was estimated to be in excess of 1000 ft. and the initial occurrence of the high-level water begins no more than 3.8 miles inland from the coast anywhere on the island. Like earlier resistivity studies, the presence of dike and fault boundaries may distort results in the high-level area. On the other hand, it may mean that the Ghyben-Herzberg relationship may not be applicable to the high-level water on Lana'i. This information combined with the fact that there are few wells within the basal aquifer lead one to conclude that the actual physical bottom location and profile of the fresh ground-water/salt water interface island-wide under Lana'i is fairly known in the basal areas but virtually unknown beyond qualitative description in the high-level areas.

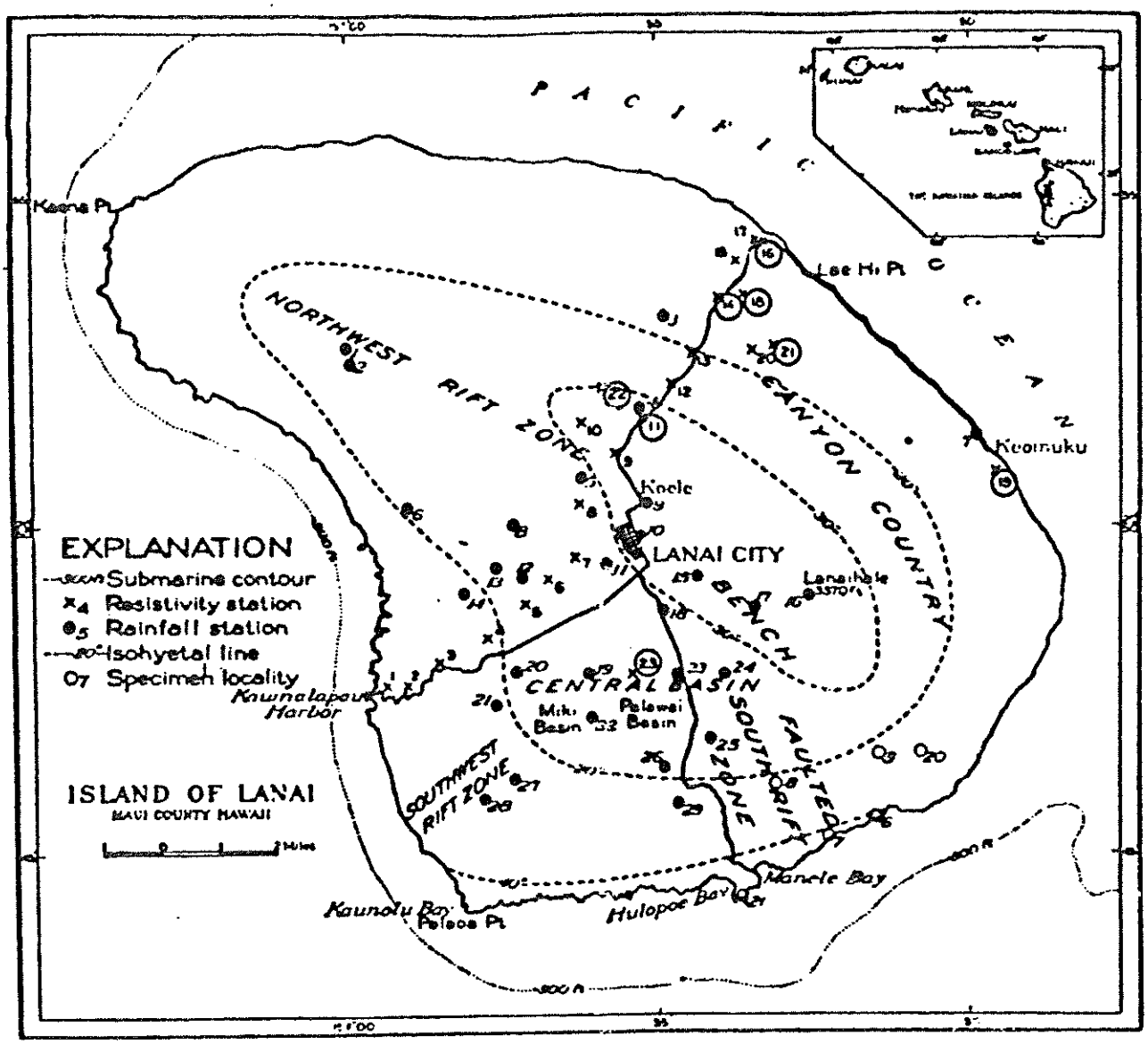


FIG. 1. Map of Lanai showing lines of equal rainfall, rainfall and resistivity stations, geomorphic divisions, and 500-foot submarine contour line. Insert map in upper right corner shows location of Lanai in the Hawaiian group.

Figure 3. Electrical Resistivity Study Stations. (Swatrz, (1940) and HLA (1986))

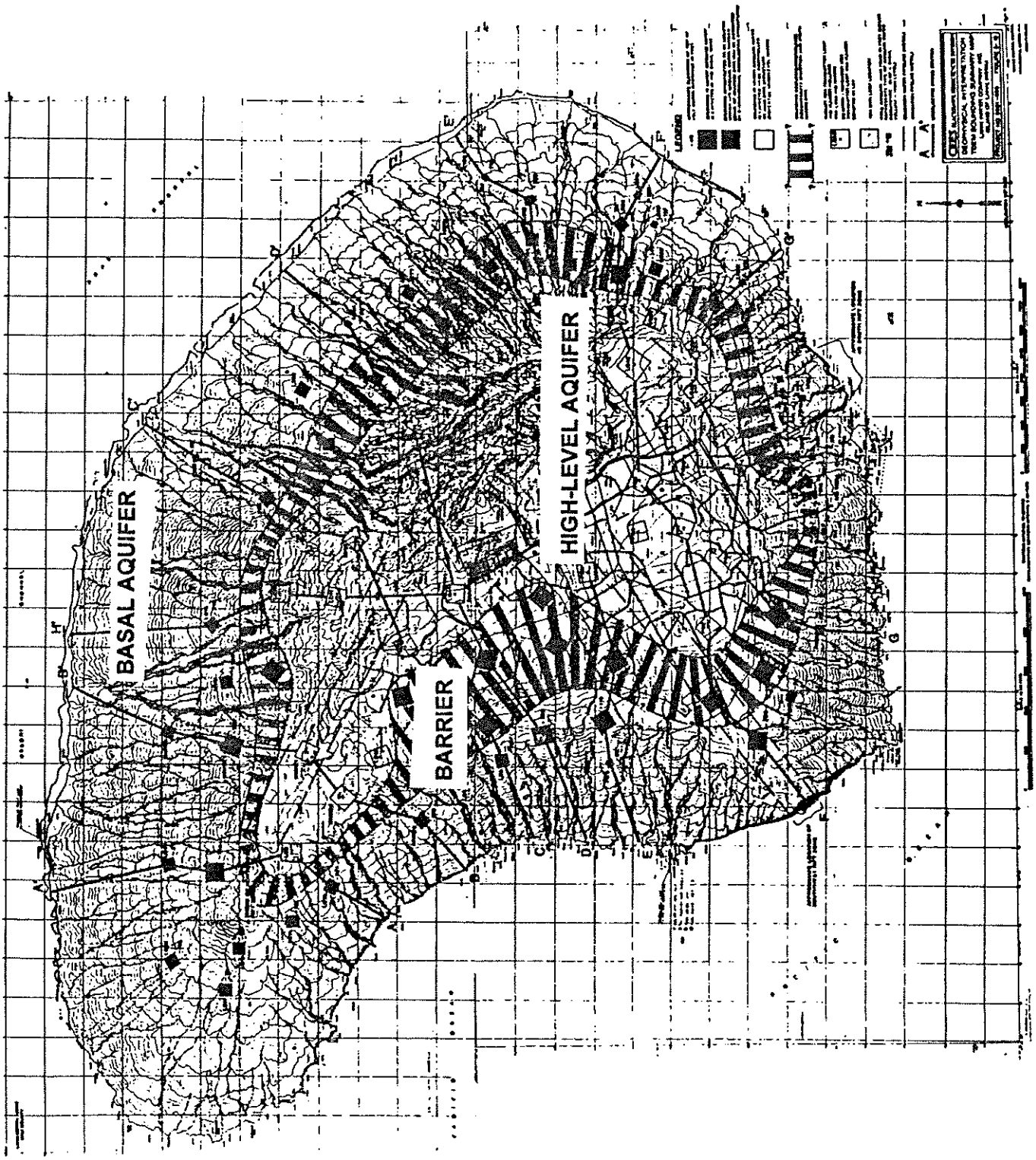
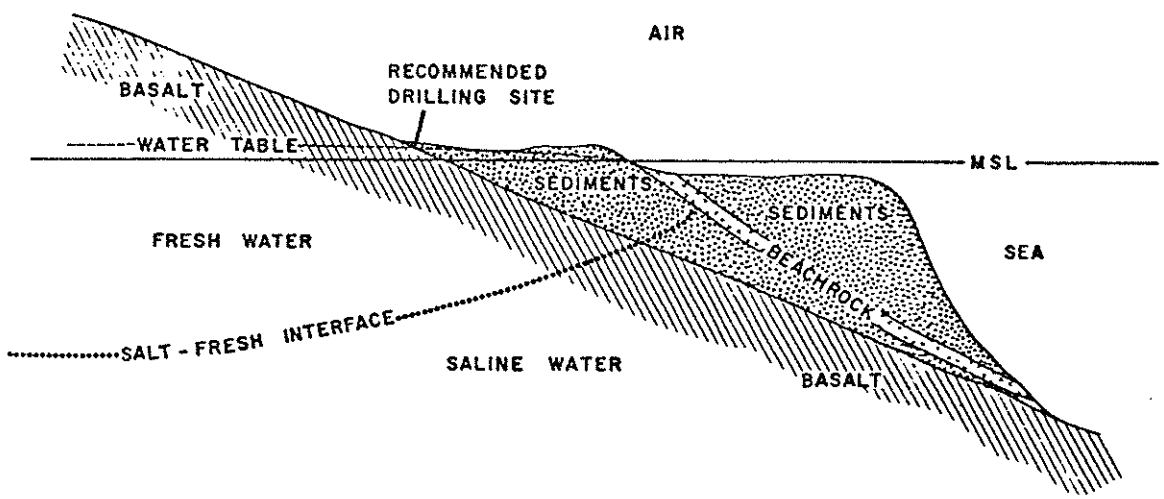


Figure 4. TDEM Study Sounding Sites & Interpretation (CEEG-BGD, 1994)

Ground-water eventually discharges all along the coast of Lana'i through a thin cross-sectional area at the toe of the basal aquifer lens (see Figure 2, pg. 5). There is little or no discernible caprock or alluvial deposits around the steep and rocky southernly shores from the western Palahinu Point to the eastern Kamaiki Point. This southern shore topography is probably the result of the prehistoric landslide known as the Clark Debris Avalanche (Moore, & others, 1989). However, on the northern coast between of these points there are alluvial deposits along the shore which may act like a caprock formation of low permeability Stearns (1940). Stearns attributed the existence of northeastern slightly-brackish wells near the shore due to this alluvial geology. Otherwise, the area would be contaminated by seawater intrusion. Through resistivity analysis, Swatrz (1940) estimated depth of alluvium at the mouth of Maunalei Gulch at 187 feet below msl. The existence of a low permeability feature was further stipulated by Adams & others (1973). According to the results of Adams's geophysical resistivity survey consisting of 176 stations and other field observations the typical shoreline profile from Kaiolohia to Naha is shown in Figure 5. Adams noted that the highest seepage outflow observed along this study area was at Lae Hi Point which happened to be a basaltic outcrop directly in contact with the ocean. This led the authors to believe a beachrock, or caprock, impediment of low permeability exists along Lanai's northern coast's alluvial sediments.



TENTATIVE MODEL OF THE HYDROGEOLOGICAL FEATURE OF THE EAST COAST OF LANAI.

Figure 5. Northshore Beachrock of Lana'i (Adams, & others, 1973)

The principal subterranean boundaries affecting the ground-water flow paths are located in the three major rift zones on Lana'i. Stearns (1940) identified the rift areas as the northwest, south, and southwest rift zones. Within the rift zones, intrusive dike and fault structures affect and control the path of ground-water flow. Locations of over 375 exposed dikes and 100 exposed fault boundaries are based on Stearn's geologic mapping of the island (see Figure 6) and help to define the extent of these rift zones on Lana'i. Undoubtedly, many unseen dike and fault boundaries must exist within the rift zones. Dikes may number between 10 to 200 per mile (Macdonald, 1956 & 1970) to 1,000 per mile (Takasaki & Mink, 1985). Additionally, a gravity survey by Krivoy & others, (1965) identified that the Palawai basin contains the island's major caldera and the possible existence of an ancient northwest rift zone and a northwest lobe (see Figure 7, pg. 12). A magnetic survey performed by Malahoff (1973) also concurred with the major rift features identified by Stearns and Kirvoy and, like Kirvoy, indicated the possible existence of northern rift zone not identified by Stearns (see Figure 8, pg. 12). Stearns stated that near Lanai City, the northwest rift zone widens and may be up to 4 miles across as a result of early dike formation with later collapsing and faulting which occurred in a more southwesterly area. As mentioned earlier, the most recent resistivity survey via TDEM (CEEG-BGD, 1994) found that initial occurrence of the high-level water begins no more than 3.8 miles inland from the coast anywhere on the island which indicates a wide areal presence of impediments to ground-water flow. It is well known that dikes are intrusions of dense rock which, when they are sufficiently numerous and intersect, form barriers which impede ground-water flow. The intersection of dikes are such that the can affect both the horizontal and vertical flow of water due to the dip and strike variabilities observed on other islands (Takasaki & Mink, 1985; Walker, 1987). Faults may also act as barriers but their effectiveness as impeding boundaries it is not as well demonstrated as dikes. However, Stearns observed and described fault breccias to which he attributed low permeability and stated that they should act like dikes in restricting ground-water flow. It is important to note that these breccias contained fragments of the intrusive rocks associated with dikes which is evidence that dikes are also shattered by faulting which may actually increase permeabilities of dike formations in some instances.

The water table makes up the final hydrologic boundary for Lana'i across which net fluxes from recharge and pumping occur and vary spatially and temporally. One could consider the isograms of hydrologic processes affecting the spatial distribution of recharge, namely; rainfall, fog-drip, runoff, and evapotranspiration, as individual hydraulic boundaries. Normally, however, these features are not considered individually in a numerical model but are lumped together into a net recharge flux term. Therefore, recharge flux is more appropriately handled through a separate water-budget analysis which is covered later in this report.

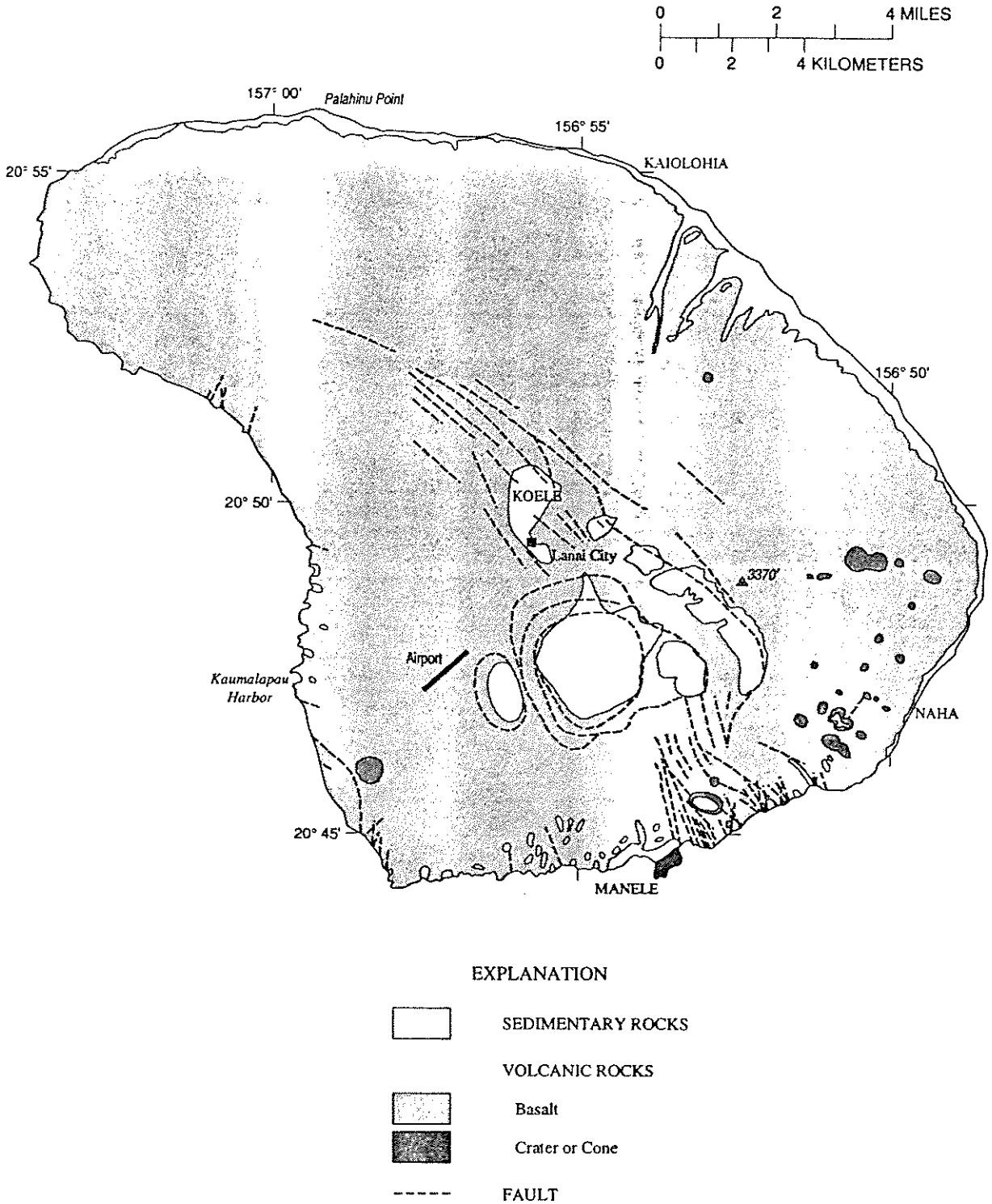


Figure 6. Geology of Lanai (modified from Stearns, 1936).

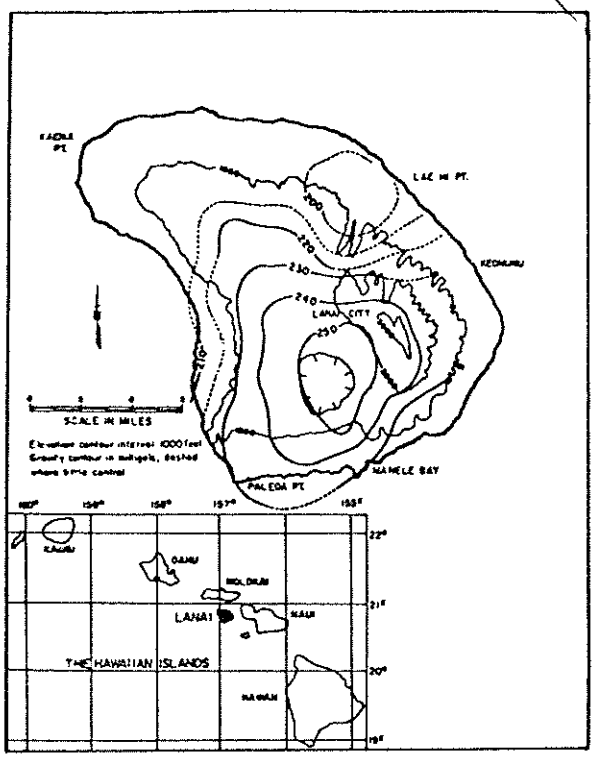


Figure 7. Gravity Survey of Lana'i (Krivoy, & others, 1963)

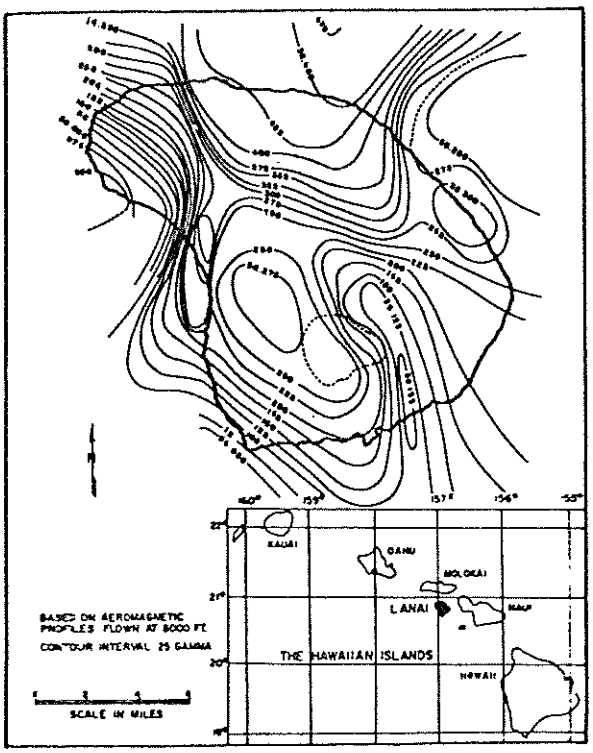


Figure 8. Magnetic Survey of Lana'i (Malahoff, & others, 1973)

Finally, there is the possibility that hydrostratigraphic boundaries, or multiple alternating types and layers of lava flows, have an effect on the isotropy and vertical flow of the model. The layered and alternating flank flow characteristics between a'a clinker zones, pahoehoe lava, and volcanic ash of the Hawaiian Islands, including Lana'i, produce anisotropic conditions. For example, there is evidence of perched conditions on Lana'i from two seeps upstream from the dry Waiapaa Tunnel (Stearns, 1940). These seeps were significant enough for drain basins to be built to collect and pipe water to cattle. However, such seeps sites are considered very localized features. Given the time and resource constraints of this study, the stratigraphy is assumed to be more or less uniform when viewed from the larger regional scale. Using this assumption obviously sacrifices any vertical anisotropy but this is a small price to pay for the benefits of creating an insightful tool which is limited to a single layer. Therefore, for the purposes of this study, the entire island of Lana'i assumed to be isotropic at the regional scale.

Ground-Water Hydraulic Properties & Parameters

General ground-water hydraulic properties described herein are specific to the dynamics of the saturated portion of the aquifer alone. Necessary parameters for solutions in a numerical ground-water model are hydraulic conductivity, transmissivity, and the storage coefficient while homogeneity and anisotropy are related issues about the spatial distribution and magnitude of these parameters. Hydraulic conductivity is a proportionality constant based on both the fluid and the medium through which it passes and is essentially the capacity of a rock to transmit water. It is based on Darcy's Law which is defined in Equation eq.(1).

$$Q = KA\left(\frac{dh}{dl}\right) \qquad \text{eq.(1)}$$

where:

Q = quantity of water per unit of time (L^3/t)
K = hydraulic conductivity (L/t)
A = cross-sectional area perpendicular to flow (L^2)
dh/dl = hydraulic gradient (dimensionless)

Hydraulic conductivity, K, differs among different rock types but may also differ from place to place within the same rock. This characteristic refers to the *homogeneity* of the rock. If the K is the same throughout the rock then it is said to be *homogeneous*. If K values differ from one area to another it is said to be *heterogeneous*. In the real world geology, rock is always heterogenous. Although one can state that locally, and in absolute terms, that K values are generally heterogenous, it was assumed that at the regional island scale that flank lava flows are homogenous while recognizing that these flows are cut by dikes and faulting of different K values as well. Dikes are denser rock and it is well established that they have lower K values than flank flows. Dike widths found in other dike complexes on Oahu range between 1 to 5 ft. thick although dike widths of 10 ft. or more are possible (Walker, 1987). However as stated earlier, they can be very numerous in a dike complex region. Additionally, extensive faulting on the island in the three major rift zones, as stated by Stearns (1940), "more than likely act similar to dikes" and should have low hydraulic conductivities although faulting probably has more variable impact of ground-water flow. Like flank flows, it is assumed that at the regional island scale effective K's for the network of dikes and faults in the rift zone are homogeneous although different than flank flows.

K values may also differ in different directions anywhere within a rock or an aquifer. This characteristic refers to the *isotropy* of the medium. If it is the same in all directions (x,y,z) it is said to be *isotropic*, if not then it is *anisotropic*. As stated earlier. the layered and alternating flank flow characteristics of the Hawaiian Islands lean towards anisotropic conditions. However, this is assumed to be insignificant at the regional island scale for the purposes of this report.

As a final note on K, it is understood that the fluid in this study refers specifically to ground-water which is assumed to be uniform throughout the aquifer. Generally, ground-water in Hawaii is uniform in temperature and dissolved constituents. However, ground-water temperatures in and near the Palawai basin are significantly elevated and since temperature affects the density and kinematic viscosity of water it will affect the hydraulic conductivity in that area of the aquifer. Therefore, this phenomena should be kept in mind when reviewing results of the model. Additionally, the ground-water dissolved solids content in Palawai basin and near shore wells are elevated which change the density of the modelled fluid.

The range of K values for basaltic rock covers twelve (12) orders of magnitude (Heath, 1982). Thus, one can appreciate the variability involved with estimating effective K values in basaltic geology such as the Hawaiian Islands. Typical values for K for flank flows in Hawaii, based on pumpage tests, range from several thousands of feet per day in flank flows to a few feet per day (Sooros, 1973). K values for geologic features such as dikes are known to have low K values which have been reported as low 10^{-5} ft/day for massive igneous rocks (Todd, 1980).

Transmissivity, T, is the product of hydraulic conductivity and the saturated thickness of an aquifer and is the capacity of an aquifer to transmit water. Transmissivity is defined in Equation eq.(2).

$$T = Kb \qquad \text{eq.(2)}$$

where:

T = Transmissivity (L^2/t)
K = Hydraulic Conductivity (L/t)
b = Saturated thickness of aquifer (L)

Since T is dependent upon the saturated thickness, b, of the aquifer and the fact that the Gyhben-Herzberg relationship (DuCommon, 1828; Ghyben, 1889; and Herzberg, 1901) exists in the Hawaiian islands, it must be understood that T is not constant but varies within Hawaiian aquifers. However, even without this assumption it is certain that the T on Lana'i is not constant. The fact that the water-levels on Lana'i vary greatly identifies greatly varying values for b. Since the bottom of the Lana'i ground-water aquifer has never been firmly established through well drilling and existing data it can only be assumed that the Gyhben-Herzberg relationship exists. If the Gyhben-Herzberg relationship does indeed exist then values for b, thus T, could range over several orders of magnitude.

Since T is dependent upon the value of K, T is subject to the same concerns of homogeneity and isotropy as is K. Again, these issues are assumed to have greater impact at the local scale rather than the regional scale of this model.

The storage coefficient, S, is the capacity of the aquifer to store water. S is defined as the volume of water that an aquifer releases from or takes into storage per unit surface area per unit change in head as follows in Equation eq.(3):

$$S = \frac{V_r}{A\,(\Delta h)} \qquad \text{eq.(3)}$$

where:

S = Storage Coefficient (dimensionless)

V_r = Volume of water released from aquifer (L^3)

A = unit surface area (L^2)

Δh = unit change in head level (L)

S is most important in determining the transient response of an aquifer to stresses such as pumping. When steady-state conditions are investigated S is set to zero (0) since transient behavior is not sought and no changes in storage will occur, i.e. water will be released from storage instantly with no time lag. Once initial steady-state conditions are determined, i.e., initial water-levels encountered are reasonably matched, then the S can be determined through transient water-level responses to pumping.

S varies depending whether the aquifer is confined or unconfined. Ground-water released from storage in confined aquifers is predominantly from aquifer compression and the expansion of water under pressure. The reasonable range of S for confined aquifers is 0.00001 to 0.001 (Heath, 1982). Ground-water released from storage in unconfined aquifers is predominantly from gravity drainage through the aquifer when water-levels decline and is essentially the aquifer's specific yield. The reasonable range of S for unconfined aquifers is 0.1 to 0.3 (Heath, 1982). Additionally, for unconfined basal lens type aquifers water could also be released from bottom storage as the transition zone rises according to the Gyhben-Herzberg relationship and could affect S values by 41 times (Eyre, & others, 1986).

The common method of estimating the parameters described above are through aquifer pumping tests. Ideally, observation wells are used to observe aquifer water-level drawdown responses to pumping wells. Such *multiple-well tests* are uncommon in Hawaii due to the additional costs involved. Typically, only the pumped well itself is the available source for aquifer test drawdown measurements. Such *single-well tests* introduce additional drawdown due to turbulent frictional forces as water leaves the aquifer and enters the well bore. Thus, most *single-well tests* have greater drawdown than that which occurs in the aquifer itself. This is a very *localized* source of error. Although this is one major source of error in estimating aquifer K, T, and S values, there are many other *localized* sources of error associated with *single-well* aquifer pump tests. These sources of error are related to the following assumptions:

a. Aquifer is infinite.
b. Aquifer is homogenous and isotropic.
c. Position and nature of aquifer boundaries.
d. Occurrence and nature of confining beds.
e. Thickness of aquifer is known.
f. Fluid is homogeneous.
g. Flow to well is uniform and horizontal only.
h. Ideally, wells are fully, not partially, penetrating into the aquifer.
i. Length of aquifer pump test period is adequate.
j. Pumping rate is constant.
k. Well losses vs. aquifer losses are known.
l. Nominal vs. effective radius of well are known.

As stated earlier, one major assumption for this model is that the regional scale the aquifer is homogeneous and isoptropic. This assumption is almost certainly invalid at the local scale associated with aquifer pumping tests. With these caveats in mind it is quite evident that the effective ***K***, ***T***, and ***S*** values can only be approximated and will be appropriate only for the grid and cell size used in this study.

For Lana'i and in the well information portion of this report, Table 13, pg. 50, lists the results of field pumping test data which estimate the ***K***, ***T***, and ***S*** parameters. The average ***K*** of nine (9) tests is 18.3 ft/day, the average ***T*** of nine (9) pump tests is 7,854 ft^2/day, and ***S***, based on one test, is 0.1. These parameters are discussed in more detail in the well information section of this report.

Water-budget Analysis

The goal of the water-budget analysis is to estimate how much water eventually reaches the ground-water table and becomes part of the ground-water system. This estimate is commonly known as ground-water recharge. What is not common is a universally accepted method for making this estimation (Anderson, & others, 1992). The general water-budget or mass-balance equation used to estimate recharge for this study was based on previous studies (Thornthwait, 1955, Shade, 1995) through Equation eq.(4) as follows:

$$RF + FD + IR - DRO - \Delta SMS - ET = R \qquad \text{eq.(4)}$$

where:

RF = Rainfall precipitation
FD = Fog-drip precipitation
IR = Irrigation return = 0 for this study.
DRO = Direct runoff
ΔSMS = Change in soil-moisture storage
ET = Evapotranspiration
R = Recharge

In reality, Equation eq.(4) is the same equation used in all other previous studies for estimating Lanai's ground-water recharge, R. In earlier studies for Lana'i the terms for fog-drip, FD, irrigation, IR, and soil-moisture storage, ΔSMS, terms were not considered; in other words these parameters were set to zero (0). Later studies began to acknowledge the impact of FD on Lanai's ground-water R. This study considers the effects of both FD and ΔSMS but continues to ignore IR effects because most of the island is unirrigated and pineapple receives little, if any, irrigation.

Differences between estimations of R were thus based on hydrologists' differences in the values assigned individual parameters in Equation eq.(4). However, all the previous parameter estimations shared a significant commonality; parameter estimations were based on total annual averages. This study's parameter estimations are based on month-to-month variations to estimate annual averages.

The contemporary methodology, or Equation eq.(4), considers the difference between potential evapotranspiration, ET_p, vs. actual evapotranspiration, ET_a, in conjunction with ΔSMS, considerations whereas previous water-budget analyses did not. Basically, this considers the available water for evaporation. The transient time periods selected could be monthly or even daily depending on the available data. Ultimately, using monthly averages for the given parameters while considering and including ΔSMS in the budget equation will result in a lower total annual value of ET_a. This is because at drier times of the year there is not enough soil-moisture available to achieve the full ET_p which may otherwise be estimated at an evaporation pan station. This is especially true during periods of drought when soil-moisture is extremely low for short periods of time (State of Hawaii, 1991). Therefore, the contemporary approach yields greater R values than those derived solely by annual averages.

Other recent recharge analyses performed in Hawaii used monthly based averages for the water-budget parameters in conjunction with a transient ΔSMS parameter to arrive at a more accurate estimate of annual R (Giambelluca, 1983, 1986 and Eyre, & others, 1986). For Lana'i, the monthly information for each parameter in Equation eq.(4), except IR, was entered and manipulated digitally with the Geographic Information System (GIS) ARC-INFO Version 6.0 (ESRI, 1992) to estimate the cell-by-cell mean monthly recharge values. This work was performed on a Data General AViiON 300 Series Workstation (Data General, 1990) in conjunction with a PRIME 9955 mini-computer (Prime, 1987). The geographic datum and projection used in this study was North American Datum of 1927 (NAD27) and the Albers Projection, respectively.

The average month-to-month input values for all the parameters are straightforward historical data substitution except for ΔSMS which uses the logical expressions in equations eq.(7) to eq.(10). ΔSMS at each cell is calculated by using a month-to-month bookkeeping procedure. First, in the GIS water-budget model the difference between a month's total precipitation (RF + FD) and direct runoff, DRO, at a given cell location represents the volume of water which infiltrates through the ground surface into the soil at that location for that month. This is shown mathematically in Equation eq.(5) as follows:

$$RF_m + FD_m - DRO_m = I_m \qquad \text{eq.(5)}$$

where:

RF_m = Mean rainfall precipitation for month m

FD_m = Mean fog-drip precipitation for month m

DRO_m = Mean direct runoff for month m

I_m = Mean infiltration, or water which passes into the soil, for month m

This infiltration, I_m, adds to the beginning or initial soil-moisture storage found at that cell location for that month. If the amount of I_m plus the beginning soil-moisture storage, $(SMS_i)_m$, exceeds the maximum soil-moisture storage capacity, SMS_{max}, the excess drains through the cell and becomes the ground-water R_m for the cell for that month. SMS_{max} is equal to the available water in the soil which is the available water capacity (soil field capacity minus the wilting point) multiplied by the root zone depth of the vegetation. For each month this is represented mathematically in Equation eq.(5) as follows:

$$I_m + (SMS_i)_m - SMS_{max} = R_m \qquad \text{eq.(6)}$$

where:

I_m = Mean infiltration for month m

$(SMS_i)_m$ = Initial soil-moisture storage at the beginning of month m

SMS_{max} = Maximum soil-moisture storage capacity = (available water capacity) x (root zone depth)

R_m = Mean recharge ≥ 0, for month $m \geq 0$

Following this calculation, evapotranspiration, ET, is then subtracted from the soil-moisture storage at the maximum monthly rate, ET_p, which is assumed to be the average amount of water which would evaporate from a properly operated Class A type pan (Ekern, & others, 1985), again, for that particular month. The justification for taking out ET after first calculating recharge is two-fold. First, R occurs mainly during storms, when RF intensity is high and ET is low. Secondly, the I rate through most soils is on the order of feet per day while ET rate is on the order of feet per year. Therefore, during and immediately after storms water can infiltrate through the ground surface and into the soil much faster than it can evaporate.

There are two different situations which affect estimating the ET_a and ending soil-moisture storage, $(SMS_i)_{m+1}$, for each month's iteration. First, if ET_p is greater than SMS_{max} then the full ET_p cannot be achieved. This means that ET_a will be less than ET_p since water stops evaporating once the soil-moisture reservoir is empty (see Figure 14, pg. 35). Therefore, ET_a is equal to either SMS_{max} or, if SMS_{max} has not been reached, something less. The $(SMS_i)_{m+1}$ term would thus always be reset to zero (0) for the next monthly iteration. This first situation of estimating monthly ET_a and $(SMS_i)_{m+1}$ is represented mathematically as follows:

If $(ET_p)_m > SMS_{max}$ then

$$(ET_a)_m = I_m + (SMS_i)_m - R_m \qquad \text{eq.(7)}$$

and

$$(SMS_i)_{m+1} = 0 \qquad \text{eq.(8)}$$

where:

$(ET_p)_m$ = Mean potential evapotranspiration for month m

$(ET_a)_m$ = Mean actual evapotranspiration for month m

$(I)_m$ = Mean infiltration for month m

$(SMS_i)_m$ = Initial soil-moisture storage at the beginning of month m

R_m = Mean recharge for month $m \geq 0$, calculated from equation eq.(5), pg. 19

$(SMS_i)_{m+1}$ = Next month's initial soil-moisture storage

In the second situation, if ET_p is less than SMS_{max}, or, if SMS_{max} has not been reached, then the full ET_p is achievable. In this case, ET_a would equal ET_p. Also, the next month's $(SMS_i)_m$ would then be some residual amount left over after ET_p has been removed from the soil-moisture reservoir. This second situation of estimating $(ET_a)_m$ and $(SMS_i)_{m+1}$ is represented mathematically as follows:

If $(ET_p)_m \leq SMS_{max}$ or $(ET_p)_m < I_m + (SMS_i)_m - R_m$ then

$$(ET_a)_m = (ET_p)_m \qquad \text{eq.(9)}$$

and

$$(SMS_i)_{m+1} = I_m + (SMS_i)_m - R_m - (ET_p)_m \qquad \text{eq.(10)}$$

where:

$(ET_p)_m$ = Mean potential evapotranspiration for month m

$(ET_a)_m$ = Mean actual evapotranspiration for month m

I_m = Mean infiltration for month m

$(SMS_i)_m$ = Initial soil-moisture storage at the beginning of month m

R_m = Mean recharge for month $m \geq 0$, calculated from equation eq.(5), pg. 19

$(SMS_i)_{m+1}$ = Next month's initial soil-moisture storage

Again, irrigation return, ***IR***, was not considered in this process for four reasons; 1) the irrigation fields were mostly outside the natural and most significant recharge area; 2) pineapple irrigation demand quantities, in general, are small; 3) potable wells are generally outside and upgradient from the irrigated areas of pineapple; and 4) since pineapple production has ceased on the island the resulting recharge without irrigation would be more indicative of present and near future recharge conditions. In addition, studies have shown that pineapple reduces evapotranspiration to amounts that are only 20% of observed pan evaporation in the same area (Ekern, 1960). In other words, ***R*** should increase in areas where pineapple cultivation occurs based on reduced ***ET*** in addition to increased ***IR***.

In essence, this entire water-budget procedure combined with the GIS constitutes a model for recharge. Therefore, there are really two (2) separate models in this study; 1) the numerical ground-water flow model and 2) the recharge model. The results of the recharge model will be used as a part of the entire input to the numerical ground-water model.

Using equations eq.(4) through eq.(10) while ignoring ***IR***, the long-term mean annual ***R*** can be calculated by summing resulting R_m values for each grid cell. This annual value of ***R*** provides cell-by-cell ***R*** input for the ground-water flow model. Our approach in calculating ***R*** is more rigorous and precise than any previous recharge work done for Lana'i. However, the true accuracy of this estimate, as with other water-budget methods, cannot be verified without a complete and long-term database of all parameters identified in equation eq.(4), pg. 18. Yet, this approach does provide a framework for and towards making more accurate future recharge estimations. Each parameter from the general Equation eq.(4), is now described in more detail for Lanai's specific situation.

Rainfall Precipitation (*RF*)

Lana'i lies in the rain shadow of West Maui and East Molokai and, consequently, the island receives relatively little rainfall, ***RF***. Since 1914, a total of 52 rain gage stations have measured ***RF*** and of these 48 were used to calculate monthly averages for the island (Giambelluca, 1986, & Figure 9). There are currently eight (8) rain gage stations still in service which are tracked by the National Weather Service. Of these, only three (3) are read daily or hourly, the rest are read weekly. All these stations report total monthly rainfall, RF_m. The longest records of RF_m come from rain gages at Lanai City, State Key No. 672, Figure 10, and Koele, State Key No. 693, Figure 11, which have a combined record of RF_m from 1892 to the present. Lanai City has daily readings since 1930 and hourly readings since 1976 (Hydrosphere, 1992). The greatest hourly intensity on record is 2 in/hr on February 4, 1979 at SKN 672.

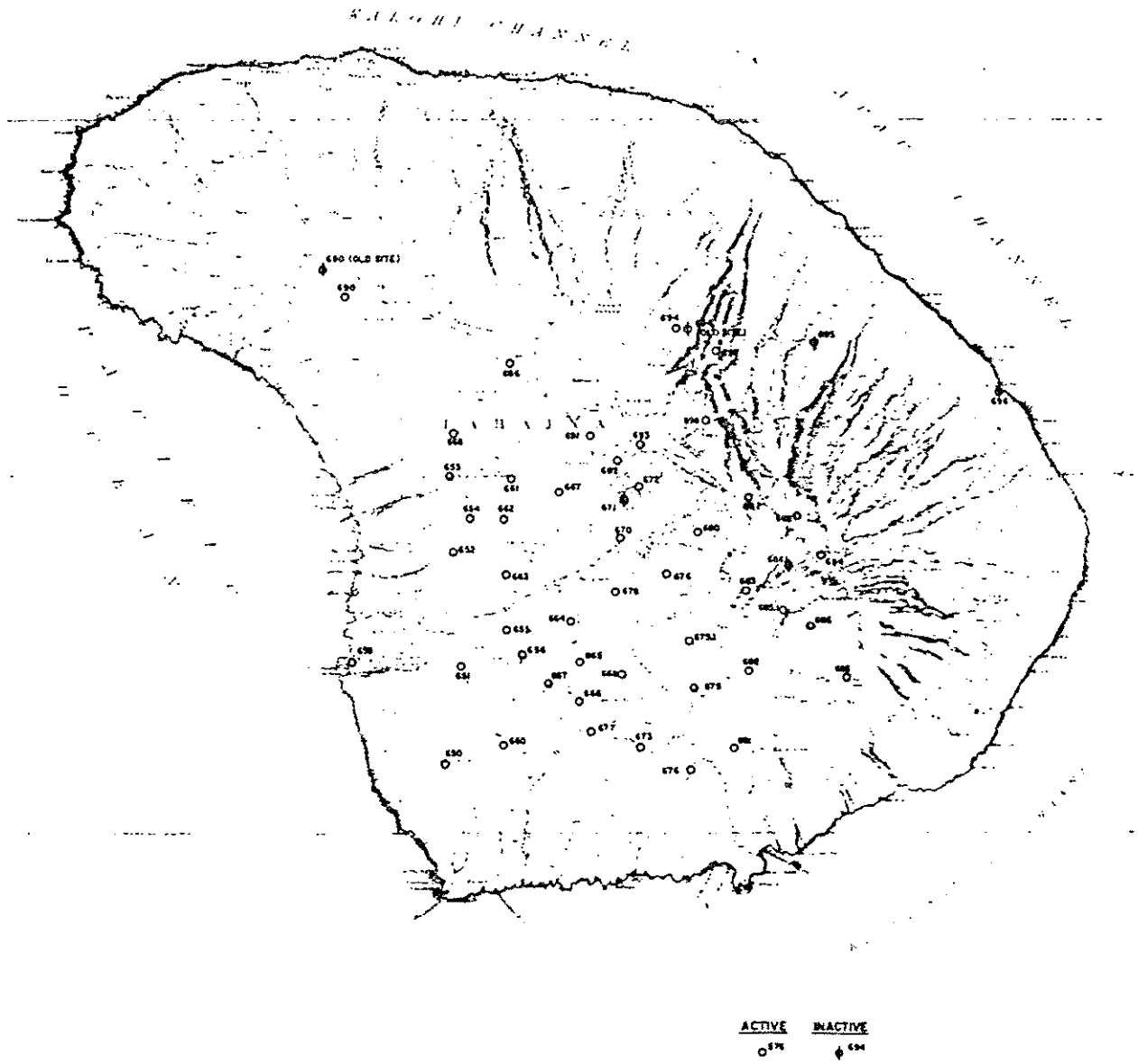


Figure 9. Rain Gage Locations for Lana'i (State of Hawaii, 1972; Giambelluca, & others, 1986)

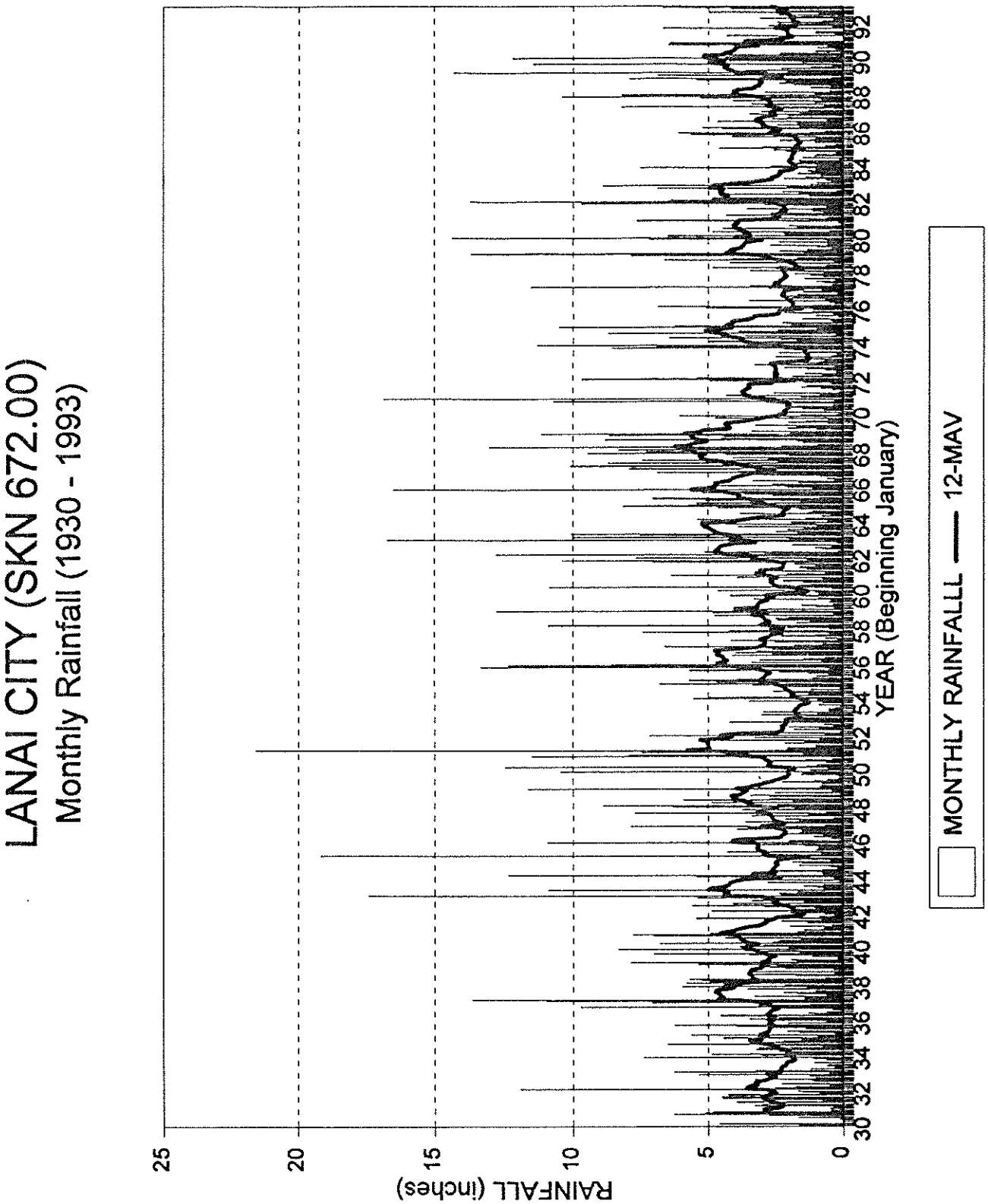


Figure 10. Monthly Rainfall at Lanai City State Key No. 672 (1930-1994)

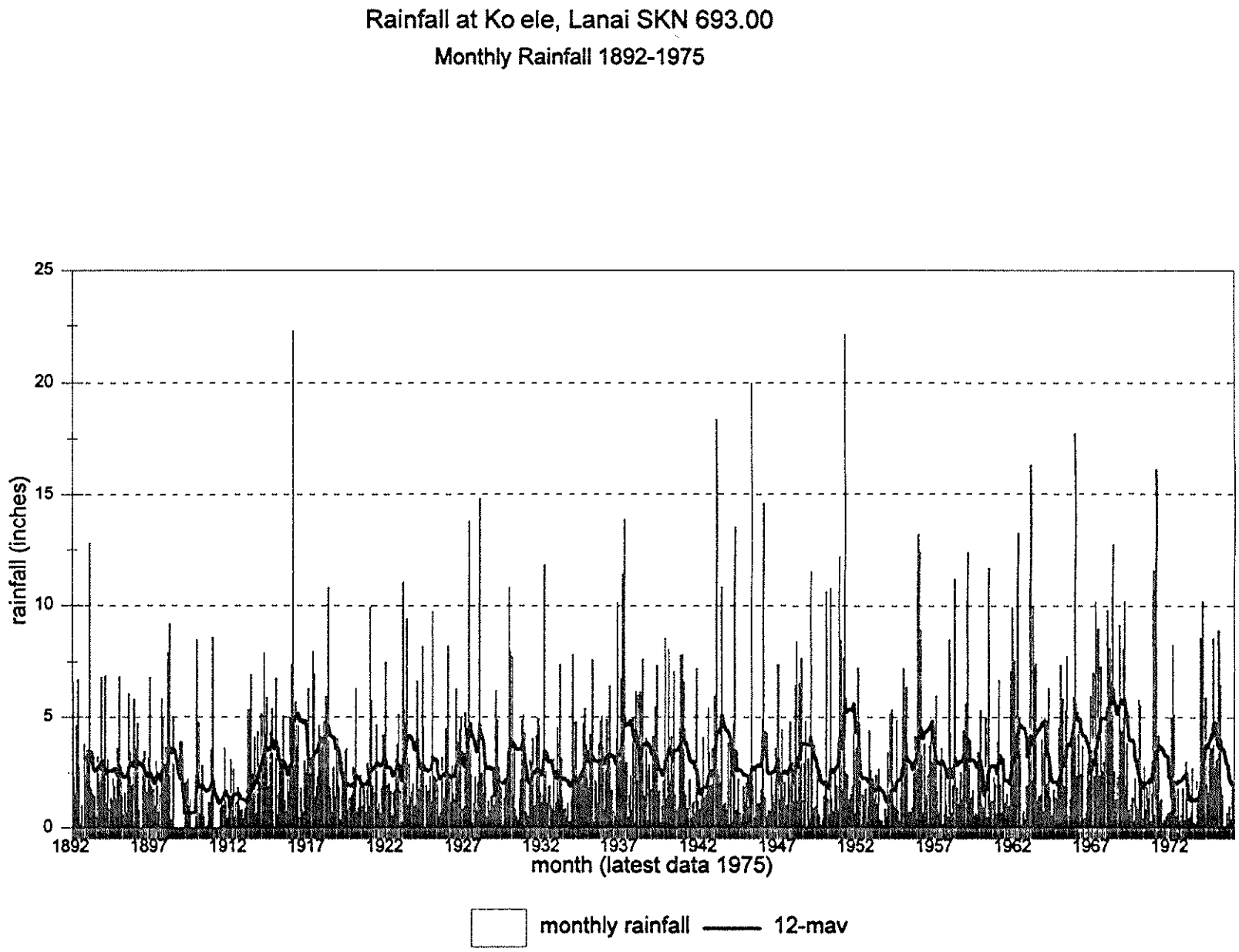


Figure 11. Monthly Rainfall at Koele State Key No. 693 (1892-1974)

Hydrologists agree that the long-term annual average ***RF*** near the summit of the island is about 38 inches (CWRM, 1990). Annual average ***RF*** contribution to the water-budget in previous studies were determined by taking areal extents of and isohyetal information and producing total average annual volumes of ***RF***. In this study, mean (average) *monthly* isohyetal information was digitized from monthly figures in State Report R76 (Giambelluca, & others, 1986) and used in conjunction with the ARC-INFO GIS to estimate mean monthly rainfall for use in Equation eq.(4). The mean annual isohyetal information is graphically shown in Figure 12.

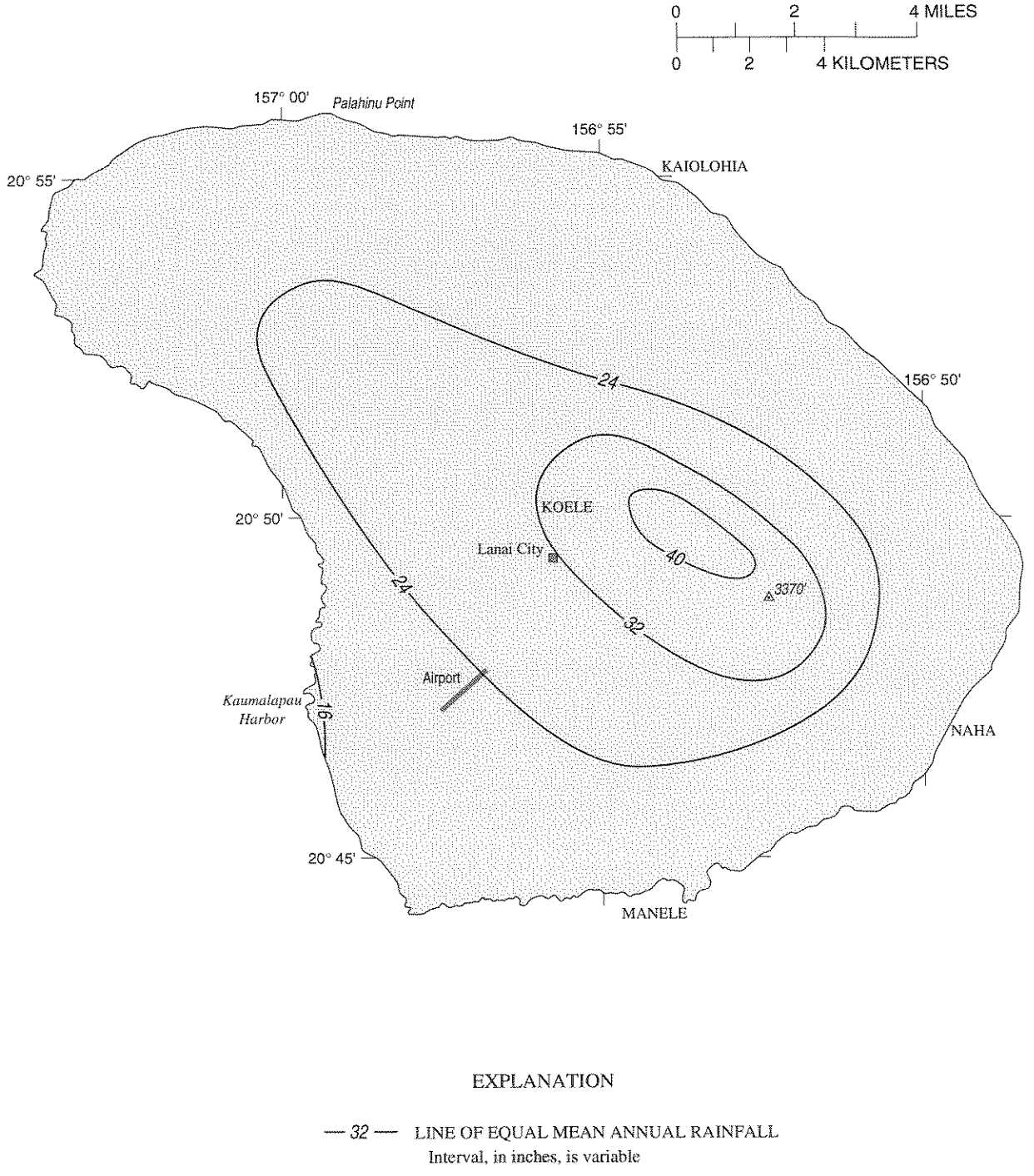


Figure 12. Mean annual rainfall for Lanai (modified from Giambelluca and others, 1986).

Fog-Drip Precipitation (*FD*)

Advective fog-drip, ***FD***, is a significant contributor to the water-budget analysis, not only for Lana'i but for the other major islands as well (Stearns, & others 1942; Hawaii Water Authority, 1959; Ekern, 1964, McKnight, & others, 1975, Juvik, & others, 1978). In its most basic description, ***FD*** is the condensation of fog or cloud water vapor on surface areas, such as leaves, until the surface area becomes saturated and water drips to the ground. ***FD*** productivity is dependant on water droplet size in the 3-100 μm range (McKnight, & others, 1975) and other factors such as humidity, temperature, forest canopy area, wind speed, etc. The phenomena is not unique to Hawaii as it has been studied in other areas of the world (Anon, 1954; Kerfoot, 1962; Kittredge, 1948; Marloth, 1905; Molchanov, 1960; Penman, 1963; Twomey, 1957, & Went, 1955). Munro (1922) perhaps made the first direct observation of ***FD*** on Lana'i. Stearns (1946) identified ***FD*** as the source of ground-water for Maui's Waikaukane Spring(s) during droughts. For Lana'i, Stearns (1940) noted that in the central seven (7) square miles surrounding Lanaihale the soil is muddy or damp for most of the year. In support of this precipitation augmentation to rainfall are several reports which cite that the vegetation and soil type on Lanaihale are indicative of a ***RF*** area greater than that measured. The State Land Study Bureau, LSB (Sahara, & others 1967) stated that the vegetation on or near Lanaihale is typical of a forest which exceeds an average annual ***RF*** of 60 inches and this apparent discrepancy with measured ***RF*** was attributed to the continuous cloud cover. SCS Soil maps of the island (Foote, 1972) identify the Kahanui-Kalae-Kanepuu and the Amalu-Olokui soil associations in the proximity of Lanaihale which are indicative of ***RF*** ranges of 30-50 inches/year and 75-150 inches/year, respectively and mention that the Kahanui Silty Clay Soil Series receives much of its moisture from ***FD***. Mink (1983) argued that ***FD*** had to exist since the vegetation around Lanaihale was indicative of a forest with a ***RF*** rate of 65 inches/year or more. Hobdy (1993) identified a cloud and mesic forest community covering the same approximate ***FD*** area for pre-polynesian conditions where, as he said, ***RF*** must have ranged from 27-50 inches/year.

Direct observations of ***FD*** on Lana'i have been documented by Munro (1922 & 1929), Fosberg (1936), Carlson (1961), and Ekern (1964). Of these, the direct measurement of ***FD*** on Lana'i by Ekern is most significant. Based on three (3) continuous years worth of data, Ekern (1964) estimated that cloud water interception (fog-drip) could increase annual precipitation below a Norfolk Island Pine tree on Lana'i by as much as 30 inches/year. Ekern's study occurred between the summers of 1955 to 1958; a period covering a range of average ***RF*** (see Figure 10, pg. 23) which encompassed both a high and low in the 12-month moving average cycle. Also, his study area was located in the middle of the ***FD*** region at an elevation (2,750 ft.) which is midway between the base of the cloud cover (2,000 ft.) and the top of the island (3,370 ft.). Therefore, Ekern's results should be a reasonable representative average for the ***FD*** region on Lana'i. Presently, Ekern feels that the 30 inches/year figure is probably the upper limit of average ***FD*** contribution from a Norfolk Pine to the water-budget for Lana'i (Ekern, personal communication, 4/19/1994). There is no compelling evidence that the climactic fog-drip potential, $\boldsymbol{FD_p}$, for a similar Norfolk Pine has changed since Ekern's work and is considered the same today. However, McKnight (1975) did design a computer program to differentiate between ***FD*** and non-vertical ***RF***, but wind data is required which was collected for only two (2) months during Ekern's study. However, it is important to remember that the overriding factor for governing actual fog-drip, $\boldsymbol{FD_a}$, is providing the medium upon which ***FD*** can condense and be harvested from the air. Therefore, changes in the type and density of the forest cover are more likely to change actual fog-drip on Lana'i than changes in the surrounding ocean or global climate.

There has been theoretical laboratory experimentation for predicting fog-drip production, but this method cannot be used due to the lack of appropriate Lana'i field data. Merriam (1973) proposed a method of predicting fog-water interception on leaves based on laboratory experimentation and also in earlier studies (1960 & 1961). He arrived at an exponential relationship but found that the there are a very large number of combinations of fog (cloud) water content, particulate matter, temperature, wind velocity, droplet size distribution, leaf surface area, leaf catching efficiency, and leaf storage capacities which would affect actual fog-drip and can vary rates by as much as 600%. These parameters have never been measured on Lana'i, or elsewhere for that matter, the method is simply impractical. This does not even consider the variability in vegetative areal distribution on Lana'i. Therefore, Ekern's field work study is more pertinent and was used in estimating ***FD*** contribution to Lanai's water-budget.

Two (2) estimates for ***FD*** were considered as potential input for the model. Both methods apply ***FD*** to areas above the base of normal cloud cover (2,000 ft.). The area encompassed by the 2,000 ft. contour is 8.36 square miles which is 17% more area than the year round damp area estimated by Stearns but is reasonably similar. The first method considered would be to use the reasonable maximum annual estimate for ***FD*** is 30 inches/year for the area above the 2,000 ft. elevation. Alternatively, a monthly ***FD*** to ***RF*** ratio (***FD/RF***) can be computed and used from Ekern's field work. Using the existing 3-year period of record of ***FD*** with the existing 82-years of monthly ***RF*** data, long-term monthly ***FD/RF*** ratios can be calculated. The resulting ratios can then be used to estimate values for monthly ***FD*** through the GIS model for ***R***.

It was decided that the monthly ***FD/RF*** ratio estimates were the more appropriate of the two methods for ***FD*** input. This is justified for four (4) reasons. First, this approach is more consistent with the overall monthly water-budget approach rather than using the 30 in/yr annual figure computed by Ekern (1964). Secondly, there is a long-term record of ***RF*** data to work with which provides a more solid basis for computing the ***FD/RF*** ratios. Thirdly, and as described earlier, the ***FD*** study was performed over a period of average ***RF***. Lastly, Ekern himself felt that the 30 in/yr figure was probably an upper limit rather than an average. The analysis and computation of monthly ***FD/RF*** ratios from Ekern's work is summarized in Table 2. Monthly ***FD*** and ***RF*** together equal total monthly precipitation.

Since ***FD*** is a significant contributor to the water-budget of Lana'i, the health of the forest canopy on Lanaihale is important. There have been concerns from Lana'i residents who have observed a significant decrease in the vegetation in the upper forest area. Historically, it is estimated that the native cloud, mesic, and dry forests once covered a much larger area than the present day forest (Hobdy, 1993). Hobdy identified four (4) major periods of forest reduction. The first began around 1400 A.D. when Hawaiians started moving to the island, with a peak population between 3000 to 3250 persons, and the undoubted forest clearing for farming and wood demand which ensued. In the 1800's goat, sheep, and hogs were introduced to the island whose combined population exceeded 50,000 in 1898 and had all but denuded the dry land forest and began to significantly impact the mesic and cloud forest cover. In the early 1900's the Gay family and, later, George C. Munro (LCo.) began and continued a goat, sheep, and hog eradication, upper forest fencing, and reforestation programs which resulted in a substantial recovery of the forest by 1927. Today, Axis Deer, introduced in the 1920's, are the present herbivore threat to the forests which has only been addressed recently, beginning around 1988, through increased hunting programs. Aerial photographic surveys done in 1954 and 1994 by the Division of Forestry and Wildlife, DLNR, are presently under examination for large scale changes in forest cover. However, this reconnaissance type of survey may not be able to determine the extent of changes in the forest undergrowth caused by the feral herbivores.

Table 2. Estimate of Monthly *FD/RF* Ratios

Month[1]	*RF* Average Rainfall Collected in Open Area[1] (in.)	Average Precipitation Collected Under Pine[2] (in.)	Average Gain Under Pine[3] (in.)	*FD* Average Fog Drip (0.375 x Gain)[4] (in.)	*FD/RF* Ratio
January	3.47	9.18	5.70	2.14	0.62
February	3.12	14.12	10.99	4.12	1.32
March	4.62	7.14	2.52	0.95	0.21
April	2.43	5.82	3.39	1.27	0.52
May	8.42	17.19	8.77	3.29	0.39
June	7.10	18.54	11.44	4.29	0.60
July	4.30	12.14	7.85	2.94	0.68
August	3.24	10.04	6.80	2.55	0.79
September	4.80	10.18	5.28	1.98	0.41
October	3.96	7.31	3.36	1.26	0.32
November	3.09	11.47	8.38	3.14	1.02
December	1.31	7.31	6.00	2.25	1.72
ANNUAL	49.85	130.43	80.49	30.18	*0.72

(Source: Ekern, 1964.)

NOTES:

FD/RF = Fog-drip to rainfall ratio.

1 = based on Ekern (1964) Table 1, 3-year period (7/55 to 6/58) of study. Average = Totals/ 3 years.

2 = 30-ft. Norfolk Pine.

3 = Actual gain measured under pine but not corrected for non-vertical rainfall capture.

4 = Corrected actual gain. Ekern assumed that of the total average annual gain of 80 in. under the tree, 50 in., or 62.5%, was attributed to captured of non-vertical rainfall. Therefore, correction factor to total average gain is 0.375

na = Not applicable.

* = based on monthly ratios. If based on annual totals, *FD/RF* = 0.605.

The resulting annual ***FD/RF*** ratio of 0.72 is the average of the monthly ***FD/RF*** ratios and compares well to ***FD*** studies which were performed after Ekern. Juvik & others, 1978) used an updated fog-catchment device and a computer program (McKnight, & others, 1975) he helped develop to isolate ***FD*** from non-vertical ***RF*** and arrived at a ***FD/RF*** ratio of 0.65 to 0.70 for Mauna Loa at the 2,500 meter (8,200 ft.) elevation. Obviously, with the studies performed on different islands and elevations one would not expect identical results but they should be within the same order of magnitude (within a factor of 10). The close agreement between the two studies suggests that Ekern's earlier estimation of ***FD*** is not unreasonable although it may be an upper estimate. As such, the results of Ekern's studies are considered the upper limit for ***FD*** contribution to ground-water ***R***.

Irrigation Return (*IR*)

Although Lana'i pineapple covered up to 16,000 acres since 1923, irrigation return water, ***IR***, effects were ignored in this study for four reasons. First, for the majority of the plantation existence, irrigation was minimal (< 2 mgd). Second, large-scale pineapple irrigation occurred only over a short period of time from 1983 to 1991 when drip irrigation allowed an increased crop yields. Third, the majority of the pineapple cultivation was located outside the area of primary ***R*** and ***FD***. Lastly, since large-scale pineapple production began to decline in 1992 and has almost ceased altogether on the island the resulting ***R*** would be more indicative of present and near-future recharge conditions.

While ignoring the ***IR*** component of the water-budget increases the conservative nature of the model, one cannot ignore that this approach does introduce a certain amount of uncertainty in ***R*** calculations. This would most affect water-levels encountered in the proximity and downgradient of irrigation; namely Wells 1, 9, 10, 12, & 13, hence a certain amount of uncertainty in water-levels encountered around the Palawai Basin, Wells 1, 9, & 10 and near Manele, Wells 12 & 13. However, most of these wells, with the exception of Well 1, were only drilled within the past seven (7) years. The pumping of upgradient wells since the 1950's has more than likely already affected water-levels in these downgradient areas and probably introduces an equal, if not greater, uncertainty in the initial water-levels encountered in these areas.

Direct Runoff (*DRO*)

In general, total runoff is a combination of direct runoff, ***DRO***, which is the portion of ***RF*** water that flows immediately after rainfall; stream baseflow, streamflow sustained by groundwater; or irrigation which flows overland and in stream or gulch channels to the ocean. ***DRO*** occurs only after interception, depression storage, and soil-infiltration rates are exceeded. This explains why in light rains there is little ***DRO***. Thus, it is during heavy rains when the majority of ***DRO*** occurs.

There is no streamflow or other ***DRO*** data for Lana'i which can be used to estimate this parameter accurately. Stearns (1940) stated that streams seldom flow except for kona storms and that Maunalei Gulch had been the only perennial stream on the island prior to its diversion by the tunnels. This description by Stearns is supplemented by the comments of Gay (1965) that the Maunalei flow in 1902 traveled a mile from its source at an estimated flow of 150,000 to 200,00 gallons per day (~ 100 gpm) and then became dry. This would indicate that Maunalei was a losing stream before any major ground-water development occurred on the island although Gay also mentioned that 'old-timers' had said the stream used to flow to the sea year round. Malo (1898) recorded that there used to be wetland taro cultivation in Maunalei. Currently, any overflow from the Maunalei Tunnels into the stream immediately infiltrates back into the ground and does not make it past Shaft 2 (McCullough, personal communication, 4/22/1995). Other previous estimations for ***DRO*** were made by simply assigning percentages of measured ***RF***. In this study, ***DRO*** was estimated by considering soil type characteristics as reported by the Soil Conservation Service (SCS) (Foote, & others, 1972; State of Hawaii, 1972). Drainability, permeability, slope, and runoff descriptions were the major soil characteristics considered in estimating ***DRO*** in relation to ***RF***. Lana'i soil data has been broken down into individual soil series and digitally compiled by the SCS on their GRASS GIS and imported to the USGS ARC-INFO GIS. The USGS GIS was used to compute individual cell monthly ***DRO*** values based on soil series characteristics in con-

junction with ***RF*** trends. The GIS soil series data for Lana'i is shown in Figure 13 and is grouped as modified soil associations (soil series polygons are too small to be shown in the figure but were used). Soil series parameters important to ***DRO*** estimation are shown in Table 3.

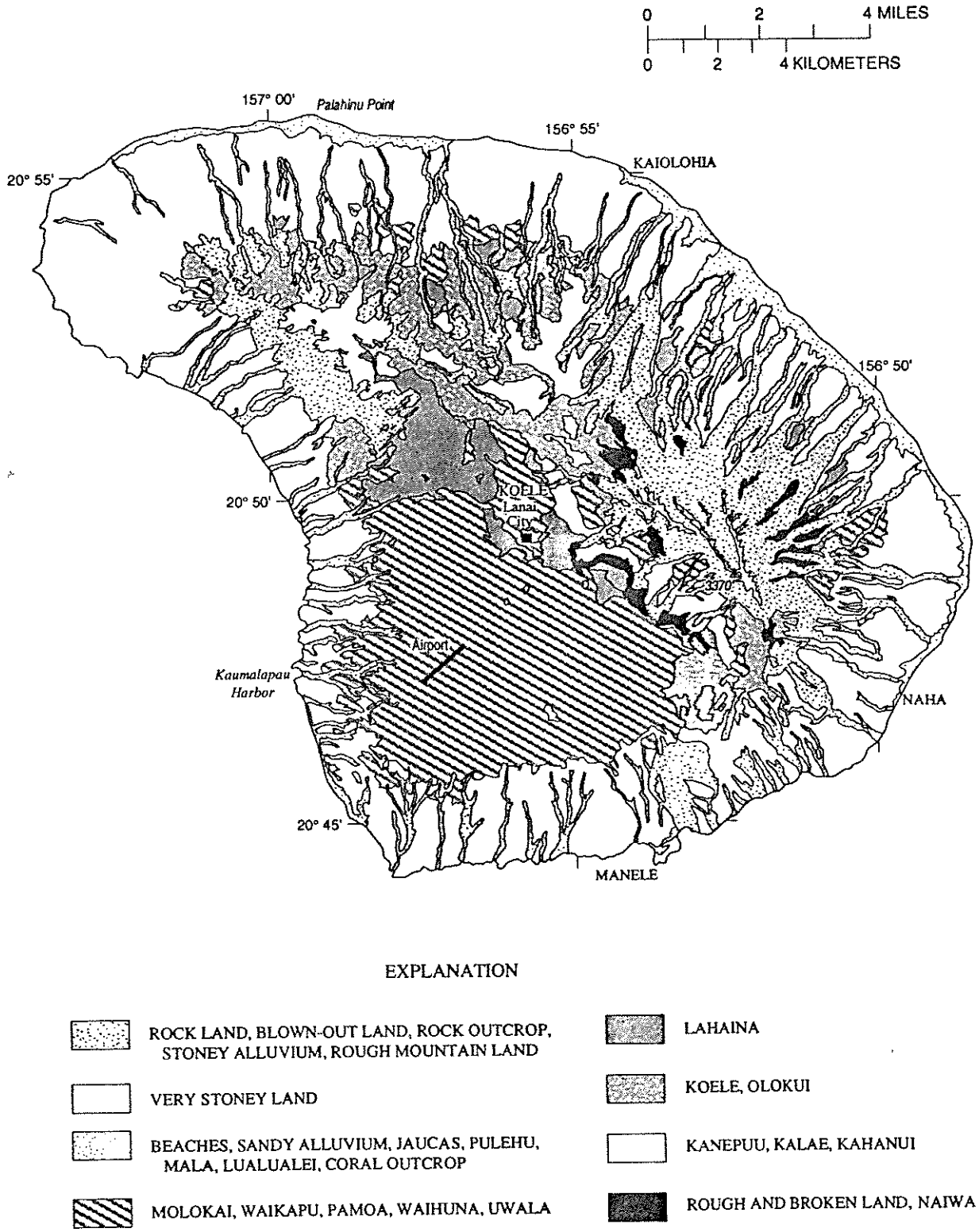


Figure 13. GIS Soil Map of Lana'i (based on Foote,& others 1972)

Table 3. Lana'i Soil Characteristics for Runoff Estimation

Soil Associations *Soil Series*	Ranges			
	Drainability	Permeability (in/hr)	Slope (%)	Runoff[1] (description)
Amalu-Olokui	**Poorly to Well Drained**	**2.0 to 6.3**	**3 to extremely steep**	**Slow to rapid**
Koele-Badland Complex	*well drained*	*2.0 to 6.3*	*40 to 70*	*na*
Koele Silty Clay Loam	*well drained*	*2.0 to 6.3*	*3 to 25*	*slow to medium*
Olokui Silty Clay Loam	*poorly drained*	*2.0 to 6.3*	*3 to 30*	*slow*
Rough Mountainous[2]	*na*	*Permeable*	*extremely steep*	*rapid[3]*
Jaucas-Mala-Pulehu	**Well Drained**	**0.20 to 20.0**	**0 to 40**	**V. Slow to rapid**
Beaches	*na*	*na*	*na*	*na*
Blown-out Land	*na*	*na*	*0 to 40*	*rapid*
Coral Outcrop	*na*	*na*	*na*	*slow[3]*
Jaucas Sand	*excessively drained*	*6.3 to 20.0*	*0 to 15*	*very slow to slow*
Mala Silty Clay	*well drained*	*0.63 to 20.0*	*0 to 7*	*slow*
Pamoa Silty Clay	*well drained*	*0.20 to 0.63*	*5 to 20*	*medium*
Pulehu Clay Loam	*well drained*	*0.63 to 2.0*	*0 to 3*	*slow*
Pulehu Sandy Loam	*well drained*	*0.63 to 2.0*	*2 to 6*	*slow*
Pulehu Stony Sandy Loam	*well drained*	*0.63 to 2.0*	*0 to 7*	*slow*
Sandy Alluvial Land	*na*	*na*	*0 to 5*	*slow[3]*
Kahanui-Kalae-Kanepuu	**Well Drained**	**0.63 to 6.3**	**2 to 25**	**Slow to rapid**
Kahanui Silty Clay	*well/moderately drained*	*2.0 to 6.3*	*3 to 20*	*na*
Kalae Silty Clay	*well drained*	*2.0 to 6.3*	*2 to 25*	*slow to rapid*
Kanepuu Silty Clay	*well drained*	*0.63 to 2.0*	*3 to 15*	*slow to rapid*
Pooku Silty Clay Loam	*well drained*	*2.0 to 6.3*	*8 to 25*	*slow to medium*
Molokai-Lahaina	**Well Drained**	**0.06 to 2.0**	**0 to 40**	**Slow to rapid**
Lahaina Silty Clay	*well drained*	*0.63 to 2.00*	*0 to 40*	*slow to medium*
Lualualei Clay	*well drained*	*0.06 to 0.20*	*0 to 2*	*slow*
Molokai Silty Clay Loam	*well drained*	*0.63 to 2.00*	*3 to 15*	*medium to rapid*
Uwala Silty Clay Loam	*well drained*	*0.63 to 2.00*	*2 to 15*	*slow to medium*
Waihuna Clay	*well/moderately drained*	*0.20 to 0.63*	*0 to 25*	*slow to medium*
Waihuna Gravelly Clay	*well/moderately drained*	*0.20 to 0.63*	*3 to 7*	*slow*
Waikapu Silty Clay Loam	*well drained*	*0.63 to 2.0*	*0 to 15*	*slow*
Very Stony-Rock Land	**na**	**na**	**0 to precipitous**	**M. slow to v. rapid**
Riverwash	*na*	*na*	*na*	*na*
Rock Land	*na*	*na*	*level to very steep*	*very rapid[3]*
Rock Outcrop	*na*	*na*	*gentle to precipitous*	*very rapid[3]*
Rough Broken Land	*na*	*na*	*40 to 70*	*rapid*
Stony Alluvial Land	*na*	*na*	*0 to 5*	*moderately slow*
Stony Blown-Out Land	*na*	*na*	*7 to 30*	*rapid*
Very Stony Land	*na*	*na*	*7 to 30*	*moderately rapid*
Very Stony Land Eroded	*na*	*na*	*3 to 40*	*moderately rapid*

(Source: Foote, & others, 1972 & State of Hawaii, Report R44, 1972.)

NOTES:

na = Not available

1 = runoff is based on permeability and slope of soil.

2 = soil mantle is very thin; 1 to 10 inches over saprolite. Saprolite is soft and permeable to water & roots.

3 = SCS data based on Smith, 10/20/94.

It is important to understand the degree with which the soils characteristics are known. The soil associations shown in Figure 13 and Table 3 are general mapping units of soil in which there is considerable uniformity in the pattern and extent of soils associations. However, individual *soil series* may differ greatly from one to another within the association and may even cross several associations. The hierarchy of soil types broken down by the SCS mapping effort is as follows: Associations, Series, and Phases. High- and medium-intensity surveys were done on cultivated areas, low-intensity surveys were made on grazing and forested land, and aerial reconnaissance-surveys were made in inaccessible areas. Therefore, on Lana'i, the extent of soils in the Molokai-Lahaina association are better known than the Kahanui-Kalae-Kanepuu, Amalu-Olokui, and Rock Land Associations.

In light of the limited ***DRO*** information, Table 4 is a summary of the approach used in this study to quantify ***DRO***.

Table 4. *DRO/RF* Ratios from Pearl Harbor for Lana'i

Pearl Harbor, Oahu					Similar soil series exist on Lana'i?
Soil Series (slope) at least 80% in a mesh element	Elements matching criteria[1]	Average Annual of Elements			
		RF[2] (in.)	*DRO*[3] (in.)	*DRO/RF* Ratio	
FL - Fill Land, Mixed (na)	1	32.98	4.31	0.13	No
HLMG- Helemano Silty Clay (30-90%)	2	70.34	8.13	0.12	No
KyA - Kunia Silty Clay (0 - 3%)	0	*na*	*na*	*na*	No
LaB - Lahaina Silty Clay (3 - 7%)	2	44.02	4.16	0.09	Yes
LeB - Leilehua Silty Clay (2 - 6%)	0	*na*	*na*	*na*	No
MuB - Molokai Silty Loam (3 - 7%)	4	38.24	2.32	0.06	Yes
MuC - Molokai Silty Loam (7 - 15%)	0	*na*	*na*	*na*	Yes
rRK - Rock Land (level to very steep)	8	41.66	5.03	0.12	Yes
rRT-Rough Mountainous Land (very steep)	0	*na*	*na*	*na*	Yes
rTP-Tropohumults-Dystrandepts(30-90%)	15	41.54	4.73	0.11	No
WaA - Wahiawa silty clay (0 - 3%)	0	*na*	*na*	*na*	Yes
WzA - Waipahu silty clay (0 - 2%)	0	*na*	*na*	*na*	No

(Sources: Foote, & others, 1972; State of Hawaii, Report R44, 1972; & Giambelluca, & others, 1983 &1986.)

NOTES:

na = Not available or applicable.

1 - number of element matches where 80%,or more, of the same soil type dominates in an finite-element cell for the Pearl Harbor RASA model, average annual rainfall ≈ 30"/yr, and topography approximates conditions on Lana'i.

2 - *RF* = Rainfall from Giambelluca (& others, 1986).

3 - *DRO* = Direct Runoff from Giambelluca (1983 & 1986).

Previous ***DRO*** estimation methodology for ***R*** analysis by Giambelluca (1983 & 1986) was considered for this study since no other measured ***DRO*** data is available for Lana'i. Giambelluca used soil series information in conjunction with SCS runoff curves to arrive at ***DRO*** values for specific soil series in the Pearl Harbor, Oahu region. Results for Pearl Harbor ***DRO*** using this method can then be compared to corresponding ***RF*** to estimate direct runoff/rainfall ratios, or ***DRO/RF***. The ***DRO/RF*** ratio is simply the percentage of ***RF*** which becomes ***DRO***. Therefore, if comparable soil series can be found between the Pearl Harbor study area and Lana'i, then ***DRO/RF*** ratios can be used estimate ***DRO*** as a percentage of the historical ***RF*** record available on Lana'i. ***DRO*** computations were done for the USGS's recently approved RASA model element mesh for Pearl Harbor. The results were reviewed with the aid of GIS to find similar conditions which exist on both islands. Table 4 summarizes the search results for dominant soil series in the RASA model's element mesh and how they relate to Lana'i.

Table 4 lists the soil series which occupied 80% or more of an element in the Pearl Harbor RASA mesh. There were 177 elements in the mesh which met this initial criteria. These elements were then checked for ***RF*** (≈ 30"/yr) and topographical (slope) conditions similar to Lanai. This resulted in a match for fourteen (14) elements among three (3) similar soil series between the two islands. Admittedly, this is a small number of soil series matches considering that there are over fifty-eight (58) individual soil series on Lana'i, but this approach considers the most contemporary estimation method for ***DRO*** in lieu of any corresponding data for Lana'i.

The three (3) ***DRO/RF*** ratios highlighted in Table 4 identify what is believed to be reasonable values for slow, medium, and rapid ***DRO*** for Lana'i. As can be seen on Table 3, pg. 31, SCS describes ***DRO*** for individual soil series *qualitatively* in categories of slow, medium, rapid, and very rapid according to soil permeability and slope. Slopes of the three similar soils, from Table 4, in their corresponding Pearl Harbor mesh element location were determined manually from UGGS quadrangle maps. The Molokai silty loam (*MuB*) elements identified in the Pearl Harbor model had typical slopes of 5% which is in the middle of the slope range described by SCS for this soil series. Similarly, the Lahaina silty clay (*LaB*) and rock land (*rRK*) elements had slopes of approximately 8%and 14%, respectively, which put them into the upper slope ranges in their soil series as described by SCS. Soil series for Lana'i can be grouped according to slope and the *qualitative* ***DRO*** description assigned by SCS. The only exception to the SCS descriptions were for *LaB* since its slope in Pearl Harbor approximated 8%. Given this arrangement, it is found that the highlighted ***DRO/RF*** ratio results from Table 4 can be used to estimate Lana'i soil ***DRO*** characteristics of similar SCS slope and *qualitative* ***DRO*** descriptions. This approach is summarized in Table 5 and constitutes the justification for use of ***DRO/RF*** ratios in the GIS analysis.

As a final check, one can compare the greatest hourly intensity of rainfall on record (2 in/hr) against the permeability rates, slope, and runoff description of soils in Table 3, pg. 31. From this comparison it is evident that the Molokai-Lahaina soil associations and series are the soils which probably produce the majority of ***DRO*** in conjunction with very steep areas. For the rest of the island there are few large events which exceed the permeability rates of the soils listed. Thus, it is reasonable to assume small percentages of ***DRO*** occur compared to the total ***RF*** measured on Lana'i. In fact, the topography of the island is indicative of limited ***DRO***. On the leeward side of Lana'i there are no valleys and only a few small gulches. On the windward side of Lana'i there exists numerous large gulches but no valleys.

Table 5. Final *DRO/RF* Ratios for Lana'i

DRO / *RF* Ratio	0.06		0.09	0.12	
Runoff@	Slow		Medium	Rapid	
Slope@	0 - 3%	>3 - 7%	>7 - 15%	>15 - 25%	25 - 70%
Soil Series	*Bs*	*KcB*	*Bw*	*KcD3*	*LaE3*
	CR#	*KhB*	*KcC*	*KrD*	*rRO#*
	JaC	*KhB2*	*KhC*	*LaD3*	*rRR#*
	KASD	*KrB*	*KhC2*	*MvD3*	*rRT#*
	LaA	*LaB3*	*KrC*	*rRK#*	
	LuA	*MmB*	*KRL*	*rSN#*	
	MmA	*MuB*	*LaB*	*WoD*	
	MuA	*PoaB*	*LaB3*		
	OOE	*UwB*	*LaC*		
	PoB	*WoB*	*LaC3*		
	PsA	*WohB*	*MuC*		
	rSL#		*MuC3*		
	WoA		*NAC*		
	WrA		*PID*		
			PID2		
			rSM#		
			rVS#		
			rVT2#		
			UwC		
			UwC3		
			WoC		
			WrC3		

NOTES:

@ = SCS data (Foote, & others, 1972 & State of Hawaii, R44, 1972)

= SCS data based on Smith, 10/20/94)

As as final note, the ***DRO*** is the amount of water that leaves the system and is not available for ***R***. In the Palawai area the affect on recharge could be significantly in error. ***DRO*** from the perimeter of the Palawai basin does not leave the system but is captured in a later scenario.

Changes in Soil-Moisture Storage (ΔSMS & SMS_{max})

With equation eq.(5), pg. 19, and ***RF***, ***FD***, ***DRO***, and ***I*** defined, we can now discuss soil-moisture in detail. It is helpful to refer to Figure 14, an idealized cell diagram, when discussing soil-moisture storage and changes in soil-moisture storage. Additionally, Figure 14 is good for visualizing the computation of monthly mean recharge, R_m.

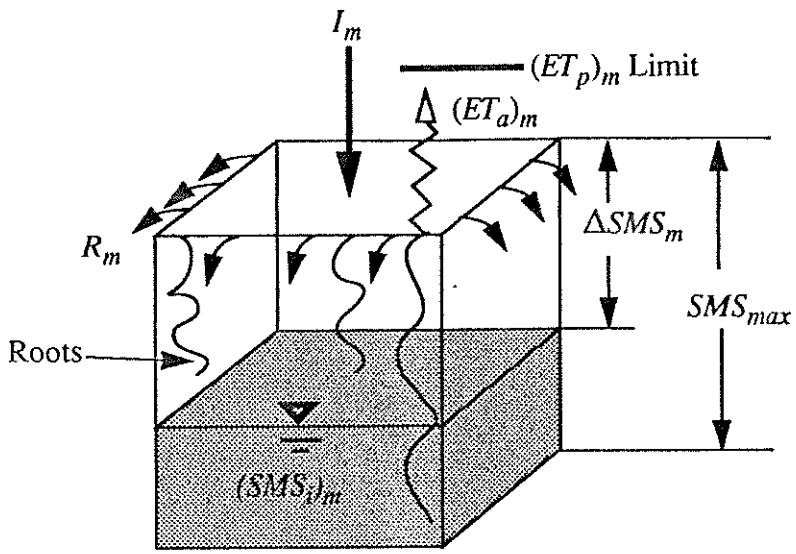


Figure 14. Soil-Moisture Storage Cell Diagram

where:

I_m = Mean infiltration for month m

$(SMS_i)_m$ = Initial soil-moisture storage at the beginning of month m

SMS_{max} = Maximum soil-moisture storage capacity = (available water capacity) x (root zone depth)

R_m = Mean recharge for month $m \geq 0$, calculated from equation eq.(5), pg. 19

$(SMS_i)_{m+1}$ = Next month's initial soil-moisture storage

$(ET_p)_m$ = Mean potential evapotranspiration for month m

$(ET_a)_m$ = Mean actual evapotranspiration for month m

It is important to understand that Figure 14 is a simplified cell diagram which represents how soil-storage is computed. SMS_{max} is the maximum volume of water which remains the soil's root zone after it is drained and capillary forces between water and the soil cannot be overcome by gravity. Drainage, which is really R, actually takes place at the bottom of the soil layer rather than overflowing the top as is shown in the cell diagram. However, the computation is equivalent.

The domain of SMS_{max} is defined by the depths of the deepest roots in a soil series and is equal to the available water capacity (soil field capacity minus the wilting point) multiplied by the root zone depth of the vegetation. Field capacity is analogous to specific retention or the water which remains in the soil after it is drained. The wilting point is the pore pressure limit which plants cannot overcome to further transpire, or use, water; hence they wilt. The root zone depth is defined as the deepest roots in the soil series where the SCS descriptions changed from any type of roots mentioned to "no roots" or if no reference to any roots occurred. This domain of SMS_{max} was assumed constant throughout the soil series without any consideration given to actual vegetative cover which probably differed spatially on all soil series. This assumption may or may not be conservative depending on the representativeness of the SCS soil description. Soil depth, maximum root zone depth, and available water capacity were reviewed in estimating SMS_{max} for all soil series. SCS information concerning these parameters for soils on Lana'i are summarized in Table 6 and soil coverages for the water-budget analysis were used from those digitized by SCS.

The monthly change in soil-moisture storage, or ΔSMS_m, is the additional volume of water necessary to fill the soil up to its SMS_{max}. Obviously, the magnitude of ΔSMS_m is dependent upon the magnitude SMS_{max}. Its domain is limited by and coincident with SMS_{max} but varies with time.

With SMS_{max} and ΔSMS_m defined, the process describing the remaining parameters in Figure 14 is straight forward. For a given month m there is a beginning soil-moisture storage value, $(SMS_i)_m$. Any average monthly infiltration water, I_m, which exceeds ΔSMS also exceeds SMS_{max} and goes towards that month's recharge, R_m. The remaining volume of water in the cell after this initial process is then decreased via and up to that month's average ET_p, or $(ET_p)_m$, and the $(SMS_i)_m$ value for the next month, $(SMS_i)_{m+1}$, is the water remaining in the soil, if any. If $(ET_p)_m$ is greater SMS_{max} than $(SMS_i)_{m+1} = 0$.

Table 6. Soil Characteristics for ΔSMS_{max} Estimation

Soil Associations *Soil Series*	Ranges Soil Depth (in.)	Maximum Root Zone Depth[@] (in.)	Available Water Capacity (in/in of soil)
Amalu-Olokui	**0 to 60**	**11 to 20**	**0.12 to 0.15**
Koele-Badland Complex	*0 to 55*	*18*	*0.12 to 0.14*
Koele Silty Clay Loam	*0 to 55*	*18*	*0.12 to 0.15*
Olokui Silty Clay Loam	*0 to 60*	*11*	*0.12 to 0.14*
Rough Mountainous[#]	*0 to 10*	*6 to 20[#]*	*na*
Jaucas-Mala-Pulehu	**0 to 62**	**0 to > 60**	**0.05 to 0.13**
Beaches	*na*	*0[$]*	*0.03 to 0.05*
Blown-out Land	*na*	*1[$]*	*0.03 to 0.05*
Coral Outcrop	*na*	*1[$]*	*0.04[%]*
Jaucas Sand	*0 to 60*	*22*	*0.05 to 0.07*
Mala Silty Clay	*0 to 40*	*40*	*0.06 to 0.13*
Pamoa Silty Clay	*0 to 62*	*62*	*0.09 to 0.11*
Pulehu Clay Loam	*0 to 60*	*60*	*0.09 to 0.13*
Pulehu Sandy Loam	*0 to 60*	*60*	*0.09 to 0.13*
Pulehu Stony Sandy Loam	*0 to 60*	*60*	*0.09 to 0.13*
Sandy Alluvial Land	*na*	*>60[$]*	*0.03 to 0.04*
Kahanui-Kalae-Kanepuu	**0 to 67**	**53 to 62**	**0.10 to 0.14**
Kahanui Silty Clay	*0 to 60*	*60*	*0.10 to 0.12*
Kalae Silty Clay	*0 to 67*	*53*	*0.12 to 0.14*
Kanepuu Silty Clay	*0 to 61*	*61*	*0.11 to 0.13*
Pooku Silty Clay Loam	*0 to 62*	*62*	*na*
Molokai-Lahaina	**0 to 72**	**15 to 60**	**0.09 to 0.14**
Lahaina Silty Clay	*0 to 60*	*46*	*0.10 to 0.13*
Lualualei Clay	*0 to 60*	*60*	*0.11 to 0.13*
Molokai Silty Clay Loam	*0 to 72*	*15*	*0.11 to 0.13*
Uwala Silty Clay Loam	*0 to 60*	*26*	*0.10 to 0.12*
Waihuna Clay	*0 to 65*	*18*	*0.09 to 0.11*
Waihuna Gravelly Clay	*0 to 65*	*18*	*0.09 to 0.11*
Waikapu Silty Clay Loam	*0 to 60*	*24*	*0.12 to 0.14*
Very Stony-Rock Land	**na**	**4 to 80**	**na**
Rock Land	*Shallow*	*55% @ 4 to 10[#]*	*0.12 to 0.16*
Rock Outcrop	*Exposed bedrock*	*10% @ 4 to 8[#]*	*na*
Rough Broken Land	*< 20*	*90% @ 40 to 80[#]*	*0.14 to 0.16*
Stony Alluvial Land	*na*	*>60[#]*	*0.05 to 0.07*
Stony Blown-Out Land	*na*	*20% @ 2 to 10[#]*	*0.07 to 0.09*
Very Stony Land	*Little soil*	*75% @ 4 to 20[#]*	*0.08 to 0.10*
Very Stony Land Eroded	*na*	*80% @ 10 to 20[#]*	*0.08 to 0.10*

(Source: Foote, & others, 1972 & State of Hawaii, Report R44, 1972.)

NOTES:

ET_p = Potential evapotranspiration

na = Not available

@ = Depth to top of profile identified as having 'no roots'.

= SCS data based on Smith, 10/20/94.

$ = Assumed

% = SCS data based on Smith, written personal communication, 10/20/94

As can be seen in Table 3, the ranges for the parameters important in estimating SMS_{max} are great. Ultimately, maximum root zone depths and average available water capacity were used for each soil series in the calculating SMS_{max}. For those available water capacities with no information reasonable values were assumed. The final GIS input values for individual soil series are summarized in Table 7 below.

Table 7. Final Parameters for Lana'i ΔSMS_{max} Estimation

Soil Series	Maximum Root Zone Depth (in.)	Available Water Capacity (in/in of soil)	Soil Series	Maximum Root Zone Depth (in.)	Available Water Capacity (in/in of soil)	Soil Series	Maximum Root Zone Depth (in.)	Available Water Capacity (in/in of soil)
BS	0	0.04	*LaC*	46	0.11	*rRR*	[a]54	[b]0.15
BW	1	0.12	*LaC3*	46	0.11	*rRT*	[a]12	[b]0.12
CR	1	[b]0.04	*LaD3*	46	0.11	*rSL*	[a]50	[b]0.04
JaC	22	0.06	*LaE3*	46	0.11	*rSM*	[a]50	[b]0.06
KASD	60	0.11	*LuA*	60	0.12	*rSN*	[a]1	[b]0.08
KRL	18	0.14	*MmA*	40	0.12	*rVS*	[a]9	[b]0.09
KcB	53	0.13	*MmB*	40	0.12	*rVT2*	[a]12	[b]0.09
KcC	53	0.13	*MuA*	15	0.12	*rRO*	[a]0.60	[b]0.04
KcD3	53	0.13	*MuB*	15	0.12	*UwB*	26	0.11
KhB	61	0.12	*MuC*	15	0.12	*UwC*	26	0.11
KhB2	61	0.12	*MuC3*	15	0.12	*UwC3*	26	0.11
KhC2	61	0.12	*MuD3*	15	0.12	*WoA*	18	0.10
KrB	18	0.14	*NAC*	52	0.10	*WoB*	18	0.10
KrC	18	0.14	*OOE*	11	0.25	*WoC*	18	0.10
KrD	18	0.14	*PID*	62	0.10	*WoD*	18	0.10
LaA	46	0.11	*PID2*	62	0.08	*WohB*	18	0.09
LaB	46	0.11	*PoB*	60	0.12	*WrA*	24	0.10
LaB3	46	0.11	*PoaB*	60	0.09	*WrC3*	24	0.10
			PsA	60	0.14			
			rRk	[a]4	[b]0.14			

a. SCS data based on Smith, 10/20/94

b. based on Simmons, N. (10/11/94) and Nakamura. S. (12/1/94) written personal communication.

(Source: Foote, & others, 1972 & State of Hawaii, Report R44, 1972.)

Evapotranspiration (ET, ET_p, & ET_a)

Evapotranspiration, ET, is the combination of evaporation and plant transpiration processes which return water to the atmosphere. It is important to understand that these two processes are very difficult to segregate (Todd, 1980). in this study, potential ET, or ET_p, is very is assumed to be the water which will evaporate from a properly operated Class A type pan. This, in turn, identifies maximum ET_p. It is also important to understand that many factors affect pan evaporation, such as temperature, humidity, solar radiation, wind, and even the height of the pan above the ground, but all these data are not available for Lana'i. It is important to note that the error associated estimating evaporation from a Class A pan itself can be as much as ± 10% (Ekern, & others, 1985, Shuttleworth, 1993). Aside from pan evaporation methods, hydrologists commonly use the Penman Equation (Penman, 1948) to estimate the potential for evaporation from the surface of water, exposed openly to the air, through aerodynamic and energy budget considerations. Chang (1968) noted that the Penman Equation only gives approximations of open water evaporation and is also different than ET_p where vegetation type and height is important. The same factors which affect ET_p also affect actual ET, or ET_a, but the influence of vegetative type and density, root-zone depth, soil-moisture storage (SMS), and density of capillary tubes in the soil are additional considerations. ET_a can be estimated as percentages of ET_p. Normally, increases in all factors result in increased ET_a although it has been shown that some vegetative cover can actually reduce ET_a such that it is significantly less than ET_p. Pineapple has been shown to reduce local ET_a by about 20% below ET_p (Ekern, 1960). However, ET_a can also exceed measured pan evaporation, ET_p. In optimum sugarcane cultivation conditions, sugarcane water requirements may go as high as factors of 1.1 to 1.2 times pan evaporation (Chang, 1961; Jones, 1980).

There is little direct pan evaporation data to estimate ET_p on Lana'i. State Report R74 (Ekern & Chang, 1985) identifies only one pan evaporation station, Station No. 687.00 at Lana'i City, having a limited duration of data collection (1957-1958) with an average rate of 25.63 in./yr. This measured amount is quite low, especially knowing that over the open ocean the pan evaporation rate is approximately 80 in./yr. The lower temperature associated with the higher elevation of Lanai City (>1500 ft. msl) is probably a major reason for this lower measurement. According to LCo. there is no additional data they have on file. Stearns (1940) stated that it is obvious that transpiration requirements are not met on Lana'i except for the seven (7) square miles around Lanaihale where the soil is muddy or damp for most of the year. Ostensibly, earlier overall ET estimates were based on professional opinion.

Although pan evaporation data is limited, three (3) methods were considered to estimate ET_p patterns. In both methods, it is assumed that ET_p is equal to pan evaporation. First, one could use Ekern & Chang's (1985) state-wide pan evaporation study conclusion that in areas beneath tradewind orographic clouds evaporation ranges from 30 to 40% less than the oceanic rate while in dry leeward areas evaporation was 30 to 40% more than the oceanic rate. These rates could then be applied uniformly for areas above and below the 2000 ft. elevation, respectively. Secondly, monthly ET_p/RF rations could be estimated and used in spatially consistent manner like the first method. Thirdly, monthly ET_p ratios can be computed from the monthly percentages of the total annual evaporation actually measured at Lana'i City.

Of the three methods considered, the third approach of estimating monthly ET_p percentages of total annual evaporation was considered the best method. Although a good rough estimate for ET_p, the windward/leeward percentage of oceanic rate was not chosen because oceanic rates around Lana'i have not been measured nor is this approach discretized enough both spatially and temporally. Because ET_p is a function of aerodynamic and energy processes, not rainfall, the method of ET_p/RF is not a valid ratio estimation. Instead, the annual total pan evaporation can be broken down into its monthly values to incorporate the monthly variations of ET_p, which can then be used with other monthly estimated parameter values with equation eq.(4), pg. 18. Although the period of data is limited, the monthly pan data provides the most direct estimate of monthly ET_p. This approach is summarized in Table 8.

Table 8. Estimate of Monthly ET_p/ET_{annual} Ratios based on Pan Data

(Source: Ekern, 1964.)

Month[1]	ET_p Average Evaporation[a] (in.)	$\frac{ET_p}{ET_{annual}}$ Ratio[b]
January	1.73	0.07
February	2.35	0.09
March	2.45	0.10
April	2.58	0.10
May	2.18	0.09
June	2.07	0.08
July	2.64	0.10
August	2.35	0.09
September	2.11	0.08
October	2.67	0.10
November	1.00	0.04
December	1.50	0.06
ET_{annual}[c]	25.63	1.00

a. unadjusted monthly data from Station No. 687.00, Ekern & Chang,1985), (1/57 to 12/57 period)

b. ET_p/ET_{annual} = Potential evapotranspiration to total annual evapotranspiration ratio.

c. For areas >2000 ft. elevation based on unadjusted data from Class A pan

To compensate for obvious areal differences, estimating monthly ET_p for Lana'i was done by dividing the island into two (2) major geographical areas. In the area above the 2000-ft. elevation, ET_{annual} = 25.63 inches/year, as shown in Table 2. In the area below the 2000 ft. elevation, the ET_{annual} value was estimated by multiplying the mean (average) of the annual average oceanic rate of 80 inches/year by 1.2. This is based Ekern's & Chang (1985) conclusion that in dry leeward areas evaporation is up to 40% more than the oceanic rate. With a 0% difference at the shoreline and 40% increases up to the 2000 ft. elevation inland, the mean (average) increase between these elevations is assumed to be 20% greater than the oceanic rate. This corresponds to approximately 95 inches/year. Therefore, it is assumed that ET_{annual} = 95 inches/year for areas below the 2000 ft. elevation contour. Now, although the calculated monthly ET_p/ET_{annual} ratios in Table 2 are based in the Lanai City area which approximates the 2000-ft. elevation area, it was assumed that these ratios were consistent island-wide. Therefore, ET_p/ET_{annual} ratios below the 2000-ft. elevation are the same below the 2000-ft. elevation as above. From this analysis, the resulting ET_p values for areas below to 2000-ft. elevation is shown in Table 9 as follows:

Table 9. Estimate of Monthly ET_p/ET_{annual} Ratios for Areas <2000-ft. Elevation

Month[1]	$\frac{ET_p}{ET_{annual}}$ Ratio	ET_p Average Evaporation (in.)
January	0.07	6.65
February	0.09	8.55
March	0.10	9.50
April	0.10	9.50
May	0.09	8.55
June	0.08	7.60
July	0.10	9.50
August	0.09	8.55
September	0.08	7.60
October	0.10	9.50
November	0.04	3.80
December	0.06	5.70
ET_{annual}	1.00	95.00

With monthly ET_p estimated for the two major areas on Lana'i, ET_a can now be calculated using equations eq.(5) or eq.(8). These equations require information regarding changes in soil-moisture storage which was described in the previous section. Since ET_a is the last parameter in equation eq.(4), pg. 18 we can now assess recharge.

Recharge (R)

Ultimately, recharge, R, is the water which makes its way to the saturated ground-water zone and provides the foundation upon which the ground-water flow model's effective aquifer parameters can be estimated. It is important to remember that R is different than infiltration, I, due to soil-moisture storage considerations (refer to Figure 14, pg. 35). Individual well/aquifer pump test information (see Table 13, pg. 50) provides localized pockets of aquifer information, that is not necessarily indicative of regional aquifer characteristics for many reasons described later. However, the parameters from the water-budget calculation, in equations eq.(4) to eq.(10), are more visible, accessible, and contain a wealth of hydrologic and time series information when compared to geologic considerations. Therefore, R is derived on a more regional and long-term basis for Lana'i than existing pump test information and provides the model with a starting flux of water which provides firmer confidence in estimating the effective hydraulic parameters during the calibration process.

Using equations eq.(4) to eq.(10), the GIS, and the previous individual parameter discussions, a reasonable long-term value for R on Lana'i can be estimated. As defined by equations eq.(4) to eq.(10), long-term R is the annual average recharge based on monthly variations amongst all contributing parameters. All available data are considered and factored into the estimate of R. The GIS water-budget model was initialized by starting with the average monthly value for ΔSMS_m after one year of simulated recharge computations.

Obviously, a longer period of record will provide a better estimate of the long-term average for any parameter under scrutiny. Rainfall, RF, has the longest period of record followed by fog-drip, FD, and pan or potential evapotranspiration, ET_p. All other water-budget parameters did not have direct data records or, in the case of irrigation return, IR, were ignored. Direct runoff, DRO, and changes in soil-moisture, ΔSMS, and actual evapotranspiration, ET_a, were estimated using the long-term RF record and soil information to create ratios as discussed earlier. FD estimation was also enhanced using a ratio to RF approach. These considerations resulted in an estimated average daily island-wide R for the island of Lana'i of approximately 62 mgd which is approximately 38% of total precipitation available ($RF + FD$). The FD area of the island contributed 13.5 mgd of the 62 mgd for island-wide R. Results of the GIS calculation for individual monthly parameters in equation eq.(4), pg. 18, are found in Appendix B.

It is difficult to make comparisons of this result with previous studies without recognizing comparable recharge areas or familiar units. Table 10 summarizes and compares previous long-term recharge analyses with this study's analysis in units of inches per year which is similar to previous studies and familiar to local residents on Lana'i. Table 11 is the conversion of Table 10 units to consistent units of million gallons per day (mgd) to facilitate the comparison between studies. This study's recharge spatial distribution pattern is also shown graphically in Figure 15, pg. 45. However, aside from the areal differences, the major difference between recharge results for this study and earlier analyses is that the nature of recharge in general is followed more closely by the GIS analysis. Recharge occurs in spurts or pulses from major rainfall events, as clearly shown Figure 14, pg. 35, thus the greater discretization of time will accommodate more spurts or pulses. Theis (1994) compared recharge and discharge to and from ground-water tables calling them "episodic" and "more or less constant", respectively, which supports this recharge concept.

Table 10. Lana'i Annual Recharge Estimates (inches/yr)

Author	Area (mi^2)	(inches/yr)				Recharge *R* (mgd)
		RF	*FD*	*DRO*	[a]ET_a	
STEARNS (1940)						
high-level	15.5	35	[c]NE		[d]26	6.46
remainder of island	126.8	19.5			[e]17	14.80
Island Total	142.3	[b]21.2			[b]17.9	21.26
ANDERSON (1961)	11.3	48.5	NE			4.1 to 5.5
ADAMS & HUBER (1973)	142.3	[f]21.2	NE	NE	[f]19.7	[g]1.7 to 9.8
BOWLES (1974)	15.5	[h]	[h]		[h]	[i]6.5
ANDERSON (1983)			NE			
MINK (1983)						
Primary	4.5	38	22.8	5.7	[j]20	7.5
Secondary	9.5	32	9.6	3.2	33	2.4
Total	14.0	[b]33.9	[b]13.8	[b]4.0	[b]28.8	[j]9.9
ANDERSON (1984)	NE	[k]28.2	[l]	NE	NE	NE
ANDERSON (1989)						
Primary	14					6.89
Secondary	10					2.00
Total	24	NE	NE	NE	NE	[m]8.9
[n]CWRM (1990)	14	28 to 35	13.8	<4.0	26 to 28.8	9
CWRM/USGS/LCo. GIS (1995)						
>2000 ft. elevation	8.36	29.84	22.28	3.29	14.92	13.50
remainder of island	132.47	23.76	0	2.11	13.50	48.10
Island Total	140.83	[b]24.12	[b]1.32	[b]2.18	[b]13.58	61.60

a. Actual evapotranspiration (& annual change in storage = 0)

b. Area weighted average estimate.

c. Not estimated

d. Steams estimated 25% of rainfall in the high-level recharge area ultimately goes to recharge. This means that Steams estimated *DRO* and *ET* to be about 75% of rainfall in the high-level recharge area, or approximately 26 inches.

e. Steams estimated 10% to 15% in the non-high-level area ultimately goes to recharge. This means that Steams estimated *DRO* and *ET* to be about 85% to 90% of rainfall in the non-high-level recharge area, or approximately 17 inches.

f. From Adams (1973) Table 3 based on Caskey (1968) methods for Waikapu, Maui recharge.

g. Range of actual pumping to estimated recharge.

h. Agrees with Steams. (High-level rainfall = 26 mgd & recharge is 25% of rainfall)

i. Also stated that *R* varies year to year with a range between 2 to 10 mgd.

j. Based on Mink's original descriptive calculations where ET was 20 inches/year. In his algebraic calculations, primary *ET* was (inadvertently or conservatively) increased to 22 inches/year resulting in his original 9.3 mgd estimation of total recharge.

k. "Effective Precipitation" defining "near-normal" (average) rainfall empirically derived as follows; 1978 rainfall data used as "near-normal" rainfall year, neglects rainfall < 0.02" or >2.50", 0.02"< 100% value of data <1.00", 1.00"< 50% value of data< 2.50.

l. Disputes Mink's fog-drip estimates of 60% and 30% of rainfall in two areas. However, offers no estimate except acknowledges that fog-drip "unquestionably contributes to recharge".

m. Based on Anderson's total of primary (0.492 mgd/sq. mi.)and secondary (0.20 mgd/sq. mi.) recharge areas. Breakdown of individual parameters not given. Based on new information from Wells 6 & 7 and Ekern's (1964) fog-drip study.

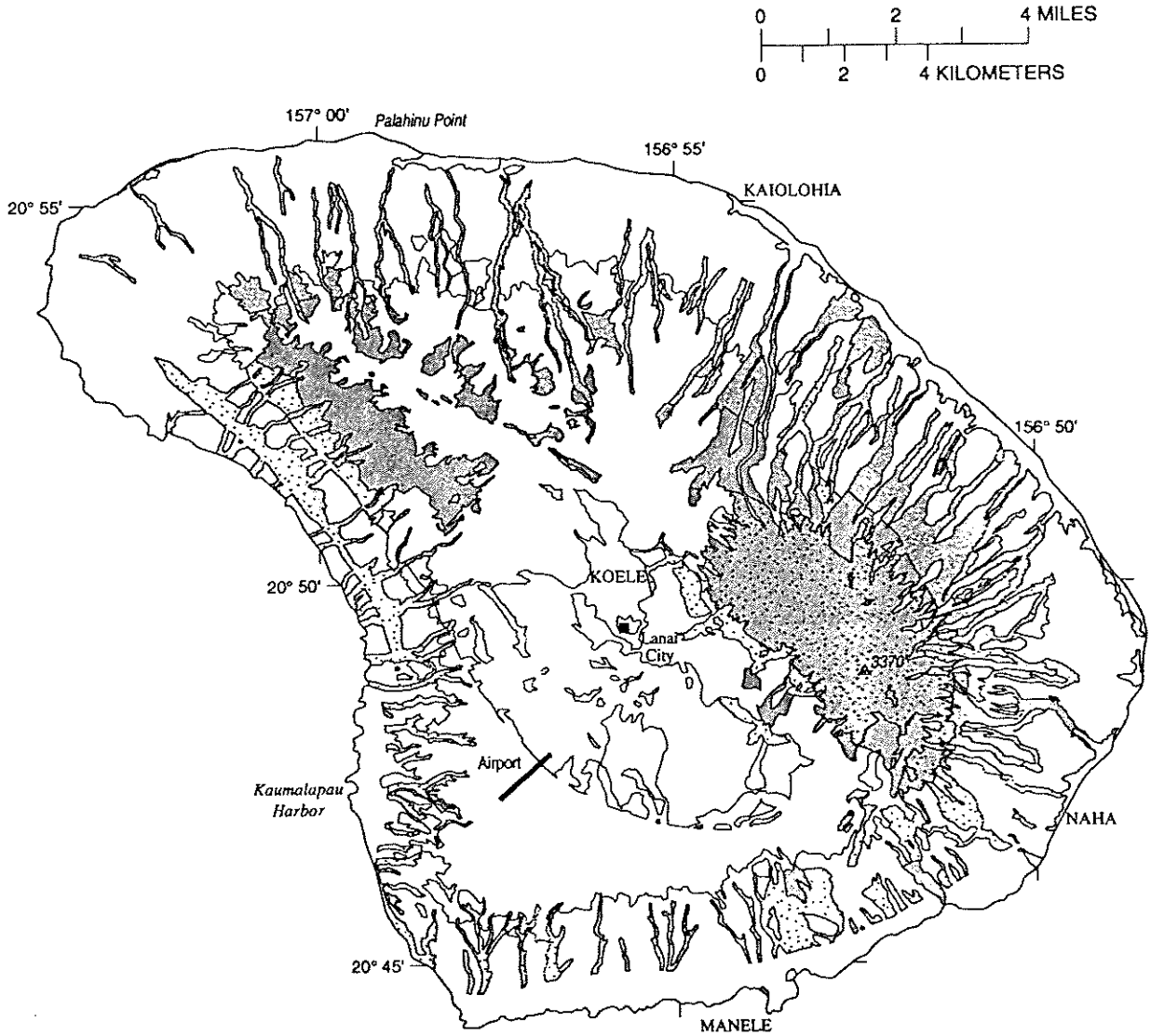
n. Synopsis of reasonable range of values from previous studies. Area is recharge area

ADDITIONAL NOTES: all footnotes also apply to Table 11

Table 11. Lana'i Annual Recharge Estimates (mgd)

Author	Area (mi^2)	(mgd)				
		RF	*FD*	*DRO*	ET_a	*R*
STEARNS (1940)						
high-level	15.5	25.8	[c]NE		[d]19.3	6.46
remainder of island	126.8	117.7			[e]102.9	14.80
Island Total	142.3	[b]143.5			[b]122.2	21.26
ANDERSON (1961)	11.3	26.1	NE			4.1 to 5.5
ADAMS & HUBER (1973)	142.3	[f]143.5	NE	NE	[f]133.8	[g]1.7 to 9.8
BOWLES (1974)	15.5	[h]	[h]		[h]	[i]6.5
ANDERSON (1983)			NE			
MINK (1983)						
Primary	4.5	8.1	4.9	1.2	[j]4.3	7.5
Secondary	9.5	14.5	4.3	1.4	15.0	2.4
Total	14.0	[b]22.6	[b]9.2	[b]2.6	[b]19.3	[j]9.9
ANDERSON (1984)	NE	[k]28.2	[l]	NE	NE	NE
ANDERSON (1989)						
Primary	14					6.89
Secondary	10					2.00
Total	24	NE	NE	NE	NE	[m]8.9
CWRM ^(1990)	14	18.7 to 23.3	9.2	<2.7	17.3 to 19.2	9
CWRM/USGS/LCo. GIS (1995)						
>2000 ft. elevation	8.36	11.88	8.87	1.31	5.94	13.50
remainder of island	132.47	140.28	0	12.44	79.74	48.10
Island Total	140.83	[b]152.16	[b]8.87	[b]13.75	[b]85.68	61.60

NOTES: (see Table 10 footnotes) rounding occurs in figures to be consistent.



EXPLANATION

MEAN ANNUAL GROUND-WATER RECHARGE, IN INCHES

- Greater than or equal to 25
- Greater than or equal to 20 and less than 25
- Greater than or equal to 15 and less than 20
- Greater than or equal to 10 and less than 15
- Greater than or equal to 5 and less than 10
- Less than 5

Figure 15. Lana'i Ground-Water Recharge Zones

There are several points to make concerning Table 10, Table 11, and the comparison with previous overall island-wide recharge results. Stearns (1940) and Adams (& others, 1973) are previous studies which specifically addressed the island-wide recharge. Mink (1983), discounted Adam's estimate stating that he "*employed an unrealistic evapotranspiration rate for the high region of the island*". Adam's approach is suspect since it is not complete and uses ***ET*** estimations derived for the Waikapu area on the island of Maui. Also, Adams's primary objective was to locate well sites on the windward side of the island for reforestation purposes and not to estimate sustainable yield for Lana'i. Therefore, Adam's small estimate for recharge is not considered rigorous enough to be valid nor comparable to other studies. Considering Stearns analysis, volumetrically, there is at least a 6% increase in the estimated average annual rainfall rate, ***RF***, from the GIS analysis. Due to the longer record of rainfall data available for this study such an increase is not unreasonable and is, in fact, considered a better estimate with greater foundation. Even Stearns noted that the available rainfall data during his survey was limited by stating: "*The rainfall records are too short to determine reliable averages*". Fog-drip, ***FD***, was not considered by Stearns and cannot be compared directly. Since direct runoff, ***DRO***, and actual evapotranspiration, ET_a, were combined in Stearns's analysis it is hard to make a direct comparison between these hydrologic parameters. Volumetrically, there is approximately a 30% decrease in the estimated average annual ET_a from Stearns to the GIS estimate. Since ***DRO*** appears to constitute only a small portion of the water-budget and all other factors except the length of time-series data is common, this decrease can be firmly attributed to the monthly basis of ***R*** calculation combined with the changes in soil-moisture storage, ΔSMS, considerations. These two considerations, as discussed earlier, should result in a lower estimate of actual evapotranspiration, ET_a than by using annual averages based on yearly totals. Other parameters were not comparable at this island-wide scale since they were not directly addressed. Therefore, it can be concluded that the two major differences between the island-wide GIS analysis and previous studies has been the reduction of ET_a and the addition of ***FD***. The GIS island-wide ***R*** estimate is almost three times the island-wide recharge amount estimated by Stearns and is attributable, at least in part, to these two major differences.

Several points can be made concerning Table 10, Table 11, and the comparison with previous ***R*** results in the ***FD*** area. Mink (1983), Anderson (1984 & 1989) and the CWRM (1990) are previous studies which specifically addressed the impact of ***FD*** on Lanai's ground-water recharge. Stearns and Bowles (1974) also concentrated on comparable ***FD*** areas but did not quantify ***FD***. There are only approximate areal comparisons of ***FD*** influenced areas ranging from a low of 8.36 to a high of 15.5 square miles. The GIS analysis has the lowest area influenced by ***FD***; 8.36 square miles. Volumetrically, the estimated annual average ***RF*** in the ***FD*** area is lower from the GIS approach than previous studies by a maximum of 47%, when compared to Mink. This is mostly attributable to the difference in area where the GIS considered 40% less area than Mink. Volumetrically, the estimated average annual ***FD*** is about 4% less in the GIS analysis than the previous studies. However, this total amount of ***FD*** estimated by the GIS is concentrated over 40% less area. Volumetrically, the estimated average annual ***DRO*** is approximately 50% less in the GIS than in the previous studies and the majority of this, too, is attributable to the difference in the ***FD*** area. Like the island-wide scope, the ET_a was lower in the GIS approach for the ***FD*** area, but by a greater percentage; 69%. However, unlike the island-wide scope, the difference in ***FD*** area, about 40% less, accounts for about one-half of this percentage difference between studies.

The other half, approximately 30%, is due to the monthly basis of ***R*** calculation combined with ΔSMS considerations as evidenced by Table 10, pg. 43, which shows the resulting inches/yr rate for ET_a significantly less in the smaller GIS ***FD*** area. One would think that in the ***FD*** area the more concentrated presence of ***FD*** would provide more water in soil-moisture storage available for potential evapotranspiration, thus ET_p can be more readily achieved. It follows that in areas lacking ***FD*** there are definitely more times when there isn't much soil-moisture storage available for ET_p to be achieved. Hence, one would expect that there should be *less* of a difference in the ***FD*** area's estimated ET_a between earlier studies and the GIS than the ***non-FD*** areas estimated ET_a since there is more opportunity for ET_p to be achieved and earlier studies assumed that annual pan evaporation rates were met. However, this is an additional example of the impact that the monthly basis of calculating and ΔSMS considerations have on estimating annual averages. Figure 16 plots the monthly variation of the water-budget parameters. As can be seen in Figure 16, summer months do not have as much water to meet the ΔSMS requirements as do winter months. For example and from Appendix B, in the month of June there is an average infiltration of only 1.30 inches while the ET_p is 2.64 inches (see Table 2, pg. 28), of which only an average of 1.17 inches is calculated to actually evaporate. Therefore, ET_p is not achieved for this month even in the ***FD*** area. Thus, despite the area differences which affect the volumetric averages it can be concluded that the two major differences between the GIS ***FD*** area and previous studies is the concentration of ***FD*** over a smaller area and the reduction of ET_a. The GIS ***FD*** area ***R*** estimate is approximately double Stearns and Bowles estimate and about 50% more than Mink, Anderson, and the CWRM estimates and is attributable, at least in part, to these two major differences.

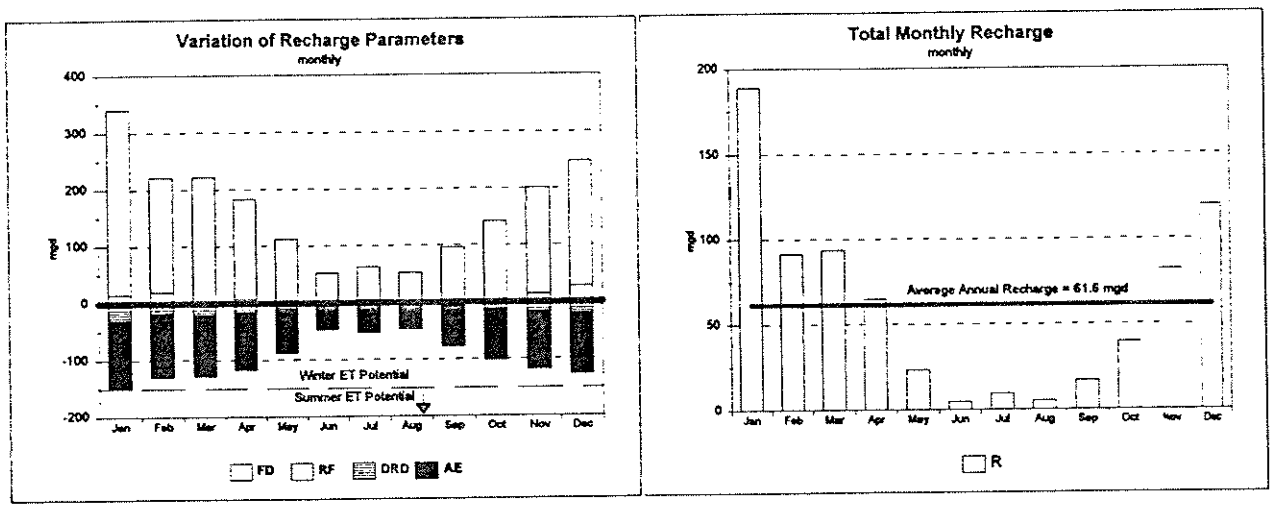


Figure 16. GIS Monthly Variation of Individual Recharge Parameters in *FD* Area

Overall, it can be said that the major differences in the results between the GIS methodology and previous studies is due to the lower estimate of ET_a and the concentration of ***FD*** over a smaller area. Despite the higher level of precision in the GIS method, all previously investigated parameters, with the exception of island-wide ET_a, did not differ greatly when areal differences are considered. There may be a cumulative effect of these smaller differences but the results indicate that these differences offset rather than amplify one another. For example, in the ***FD*** area, though the GIS estimates less ***DRO*** than Mink's there is also less ***RF*** and ***FD*** due to the differing areal domain. Also, it is interesting to note that ET_a due strictly to the month-to-month basis of calculation and ΔSMS considerations are at about the same rate for ***FD*** and ***non-FD*** areas; about 30% of ***RF***.

A recharge scenario devoid of ***FD*** was investigated due to the concern over the health of the fog forest on Lana'i and the corresponding potential impacts on Lanai's ground-water resources. If the forest leaf area is significantly lowered than ***FD*** may be affected similarly. The conservative approach was taken where all ***FD*** was removed although its total absence is unlikely. The results of this analysis are summarized in Table 12 below.

Table 12. *FD* vs. No *FD* Recharge Estimates

FD Status	Author	Area (mi^2)	(mgd)				
			RF	*FD*	*DRO*	ET_a	*R*
FD	CWRM/USGS GIS (1994)						
	>2000 ft. elevation	8.36	11.88	8.87	1.31	5.94	13.50
	remainder of island	132.47	140.28	0	12.44	79.74	48.10
	Island Total	140.83	152.16	8.87	13.75	85.68	61.60
No *FD*	CWRM/USGS GIS (1994)						
	>2000 ft. elevation	8.36	11.88	0	1.31	5.49	5.08
	remainder of island	132.47	140.28	0	12.44	79.74	48.10
	Island Total	140.83	152.16	0	13.75	85.23	53.18

As can be seen from Table 12, the effect of ignoring ***FD*** is an 8.87 mgd loss to ***R*** in the areas above the 2000 ft. elevation resulting in a decreased estimate of ***R*** for the ***FD*** area from 13.50 to 5.08 mgd. The reduction to island-wide ***R*** is small, 14%, compared to the reduction to ***R*** in the ***FD*** influenced area; 62%. This clearly indicates that ***FD*** constitutes a major portion of ***R*** in the ***FD*** area.

Finally, ***DRO*** captured in the Palawai basin topographical depression can increase infiltration above that estimated by the GIS methodology. This was investigated by not allowing ***DRO*** to occur in grid cells within the Palawai basin. This analysis found that an additional 1 mgd could be added to the total island ***R*** for this consideration. Given that this constitutes less than 2% of the island-wide ***R*** with ***FD*** and without ***FD*** it was assumed that this ignorance of captured ***DRO*** is not a significant error on the regional scale. However, such a change in the more localized area of the Palawai basin may be significant, especially since there are important wells within the basin.

Existing Wells, Historical Pumpage, and Water-Levels

There are twenty-four (24) wells with information helpful to the modeling effort. A new well, Well 14 is currently under construction. The location of these wells are shown Figure 1, pg. 2. These wells and their information relevant to producing a flow-model are listed in Table 13, pg. 50, and Figures 17 through 30. Individual chloride information has been omitted to emphasize the flow-type nature of the model. Both water-levels and pumpage from these wells vary temporally according to seasonal and operational changes and are shown for each well and the cumulative pumpage in Figures 17 through 30. Magnified views of monthly water-level responses for each well can be found in Appendix H.

On an island-wide basis, Lana'i has a long record of both pumpage and water-level data. The historical record of pumpage and water-level data spans from 1926 to the present. Records from 1926 to 1939 and 1942 to 1985 were found on file at the USGS and records from 1988 to the present are found in CWRM files. Records for 1986 through 1987 were provided by LCo.

Aquifer hydraulic parameters are also listed in Table 13. The three (3) hydraulic parameters listed are hydraulic conductivity, ***K***, transmissivity, ***T***, and the storage coefficient, ***S***. These parameters, their significance, and how they are obtained were discussed earlier and in more detail. It is important to note that there are nine (9) estimates for ***K*** and ***T*** but only one (1) estimate for ***S***. This highlights the fact that *single-well* pumping tests were the conditions under which the majority of these parameters were obtained. Therefore, for reasons outlined earlier, these values were obtained under less than ideal situations. Thus, errors are present it should be understood that the values in Table 13, pg. 50, are not absolute nor necessarily accurate. However, they do provide a reasonable range to begin the flow model parameter estimation process. Where possible, reported values were checked using pump analysis software (Geraghty, 1989).

The average ***T*** value from nine (9) high-level pump tests is 7,854 ft^2/day. However, ***T*** values are not accurately known because accurate high-level aquifer thicknesses, ***b***, are unknown and vary between analyses.

The average ***K*** value from nine (9) high-level pump tests is 18.3 ft/day. Like ***T*** values, ***K*** values are very rough approximations since ***b*** is unknown Typical values for ***K*** in basalt can range from 10^{-7} to 10^{5} f./day (Heath, 1982). Research by Sooros (1973) estimated the range for Pearl Harbor flank flows between 7 to 8500 ft/day. For dike complexes outside of caldera regions on southeastern Oahu, Takasaki & Mink (1982) had estimated a range for ***K*** from 1 to 500 ft/day. Therefore, the average ***K*** is for Lana'i is consistent with values for dike complexes. However, several of these pump tests, specifically wells 1, 3, and 9 are known to have encountered flow boundaries. Therefore, ***K*** values are probably higher than those estimated from past pump tests. Also, ***K*** values were estimated by consultants assuming different aquifer thicknesses. Additionally, the pump test for Shaft 1 indicates a much higher ***K*** value for the basal regions of Lana'i.

Typical values for ***S*** range from 0.1 to 0.3 for unconfined aquifers. However, only one (1) estimate for ***S*** was made by Mink (1983) based on an observation well, T-2, data. ***S*** is important for transient model simulations only. As stated earlier, ***S*** could be 41 times for a lens type situation. However, since the high-level aquifer is not known to follow the Gyhben-Herzberg relationship, unknown lag-time considerations of transition zone movement, and transmissivity would have to be modified as well, it is probable that 0.1 to 0.3 is a reasonable range.

Table 13. Existing Lana'i Wells

Well No.	Well Name	Year Initially Drilled	Initial Water-Level Elevation (ft. msl)	Initial Bottom of Well Elevation (ft. msl)	*K* (ft/day)	*T* (ft^2/day)	*S*	Historical Pumpage/ Water-Levels
4454-01	Manele	[a]na	2.5	na	na	na	na	na
4552-01	Well 12	1990	5	-25			na	na
4553-01	Well 13	1990	0	-25			na	na
4555-01	Well 10	1989	208	208			na	na
4852-01	MH Tunnel	1918	Dry	2,700	na	na	na	na
4852-02	Well 5	1950	1,570	1174	[bc]16.4	[bc]6,412	na	Figure 17
4852-03	USGS T-2	na	na	na	[bc]11.2	[bc]4,355	[b]0.1	na
4853-01	Gay Tunnel	1920	Dry	1,920	na	na	na	na
4853-02	Well 1	1945	818	-3	[de]4.8	[de]3,740	na	Figure 18
4854-01	Well 9	1990	[f]808	446	[de]3.2	[de]2,670	na	Figure 19
4952-01	Waiapaa Tun.	1924	Dry	2,220	na	na	na	na
4952-02	Well 4	1950	1,589	1,149	[bc]6.0	[bc]2,663	na	Figure 20
4953-01	Well 2	1946	1,544	903			na	Figure 21
4953-02	Shaft 3	1954	1,553	[g]1,510			na	Figure 22
4954-01	Well 3	1950	[h]1,124	651	[bce]6.1	[bce]2,902	na	Figure 23
4954-02	Well 8	1990	1,014	412	[i]16.5	[i]9,900	na	Figure 24
5053-01	Lower Tunnel	1911	1,103	1,103	na	na	na	Figure 25
5053-02	Upper Tunnel	1911	1,500	1,500	na	na	na	Figure 26
5054-01	USGS T-3	1950	[k]1,064	ground-928.6	na	na	na	na
5054-02	Well 6	1986	1,005	600	[l]88.6	[l]35,640	na	Figure 27
5055-01	Well 7	1987	650	450	[j]12	[c]2,400	na	na
5149-01	Gay Well A	1900	2	-44	na	na	na	na
5154-01	Shaft 2	1938	735	479	na	na	na	Figure 28
5253-01	Shaft 1	1936	2.4	1.4	[m]4,500	[m]450,000	na	Figure 29
TOTAL Data	24 wells	na	22	20	9	9	1	Figure 30
AVERAGE	na	na	na	na	[n]18.3	[n]7,854	0.1	Figure 30

a. not available/ not applicable
b. Mink (1983), Jacob's Method & b =I initial head to bottom of well (u=0.08 @ T2).
c. based on recovery data & Theis method.
d. Nance (1993), Jacob's Method & b = initial water-level above sea level.
e. Probable boundary encountered
f. Updated from K. Takasaki x/x/9x field investigation and resurveyed ground elevation information.
g. based on Stearns (1953 & 1959) length of tunnel behind bulkhead is 745.5 ft.
h. based on Stearns (1959).
i. Pump test report M&E Pacific (1991), Modified Soroos Method.
j. b= water table to bottom of well.
k. based on Stearns (1959).
l. Soroos Method (1973) modified.
m. Based on Theis equation although Theim is more appropriate no observation. wells (Takasaki & Mink, 1982); probably too high.
n. not including results from Shaft 1 since it is a basal source.

Other Notes to Table 13

K = estimated hydraulic conductivity from assuming aquifer thicknesses and *T* results.
T = estimated transmissivity from pump tests.
S = storage coefficient.
msl = mean sea level

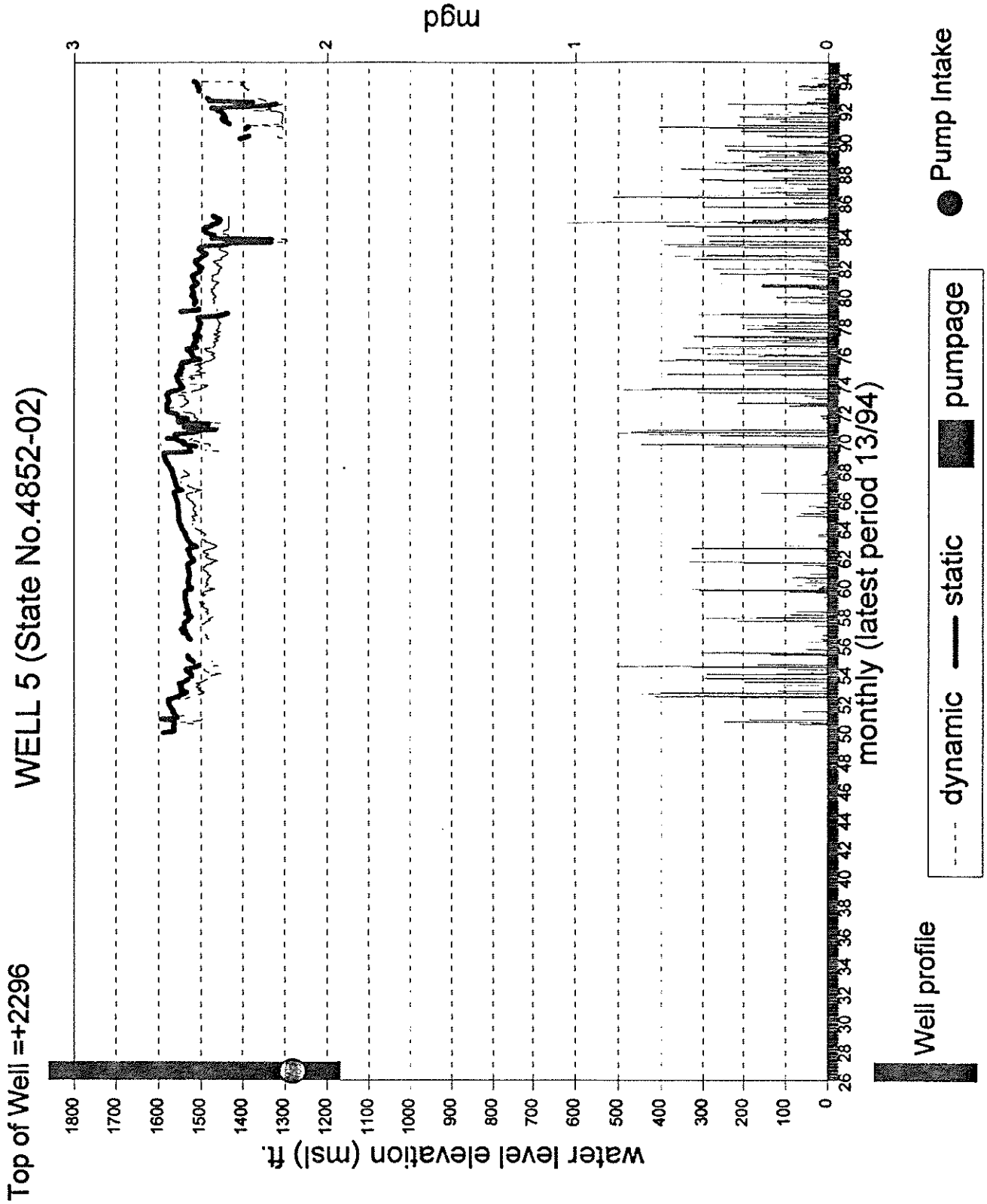


Figure 17. Well No.4852-02, Well 5 Historical Pumpage and Water Levels

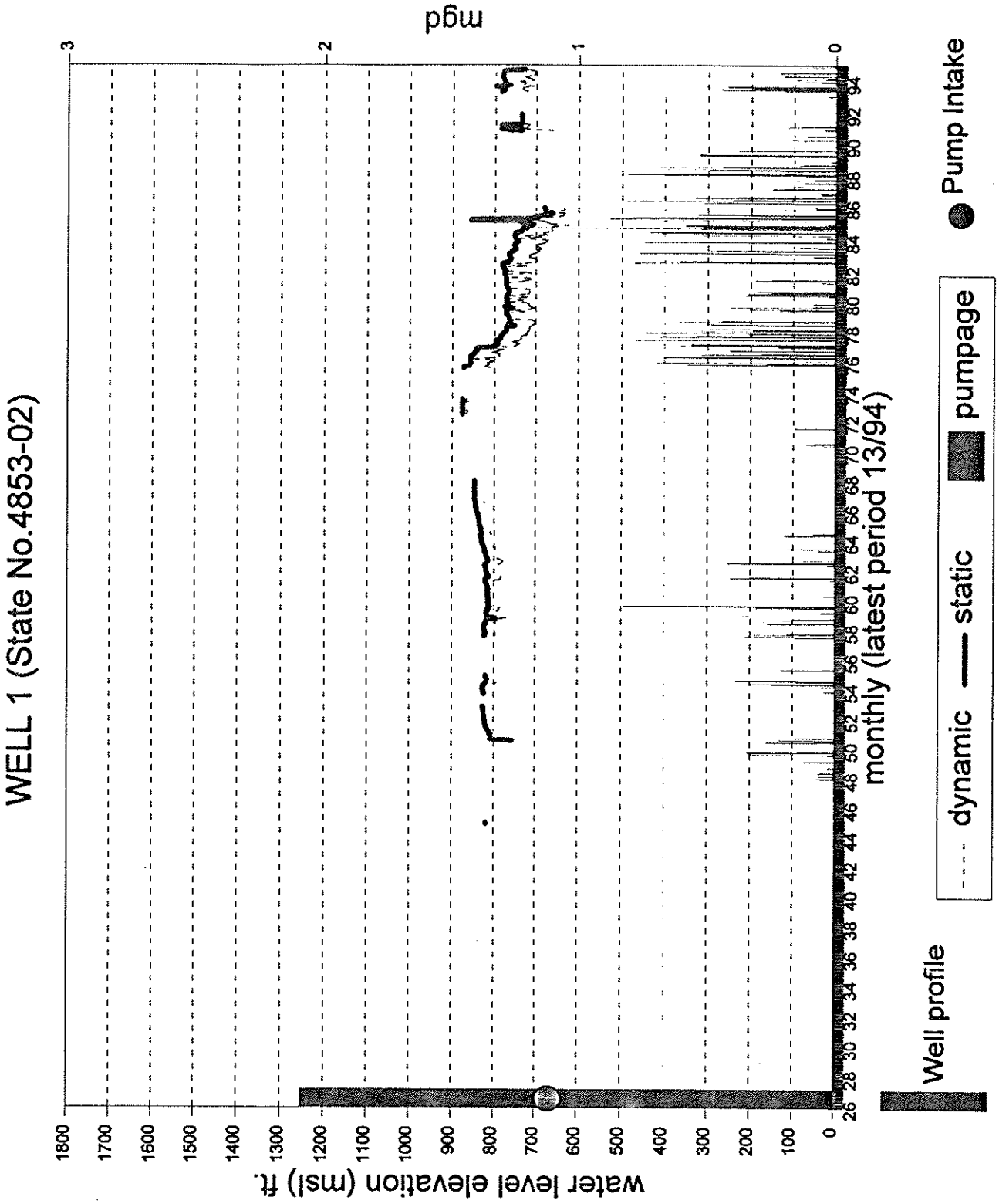


Figure 18. Well No.4853-02, Well 1 Historical Pumpage and Water Levels

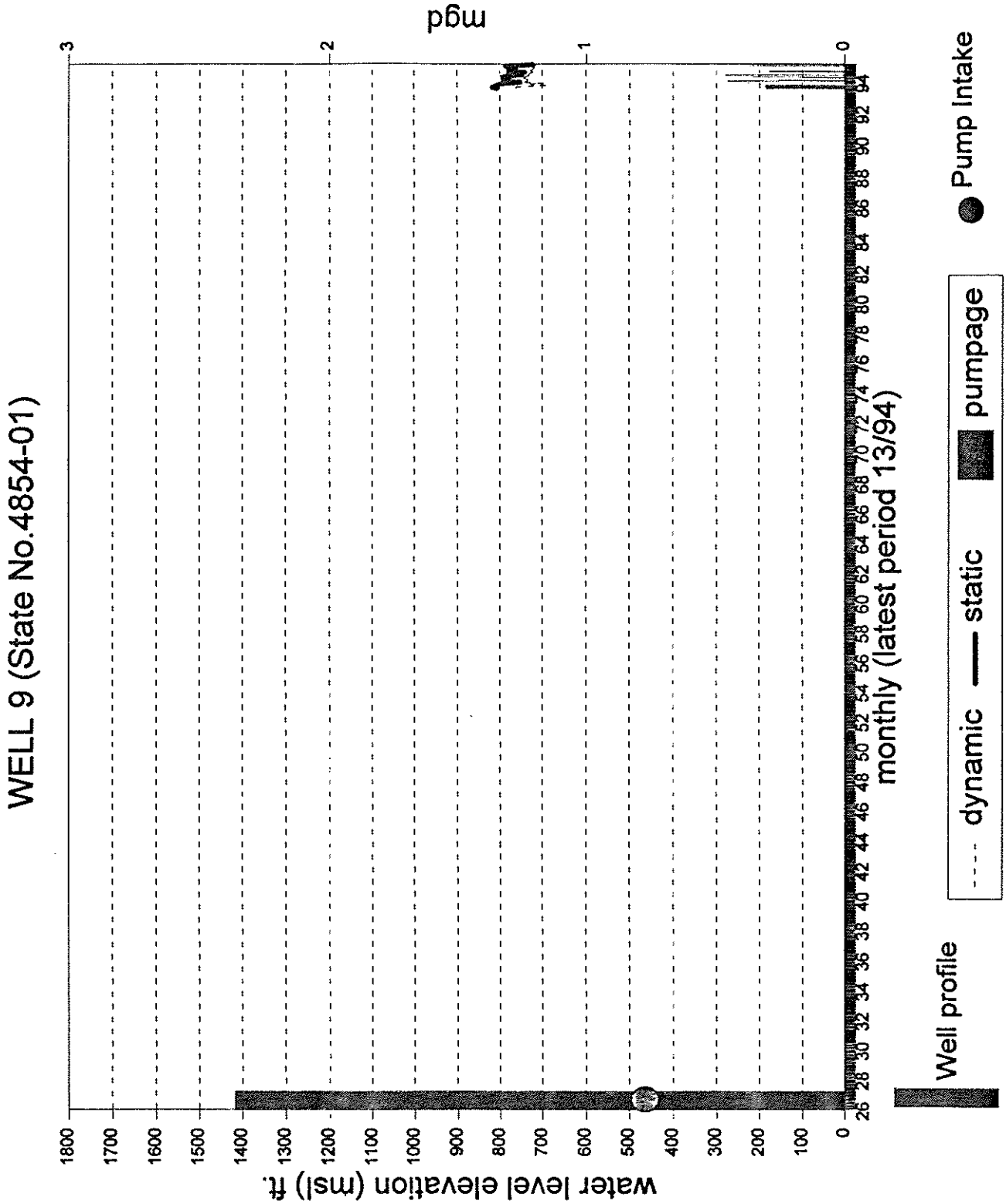


Figure 19. Well No.4854-01, Well 9 Historical Pumpage and Water Levels

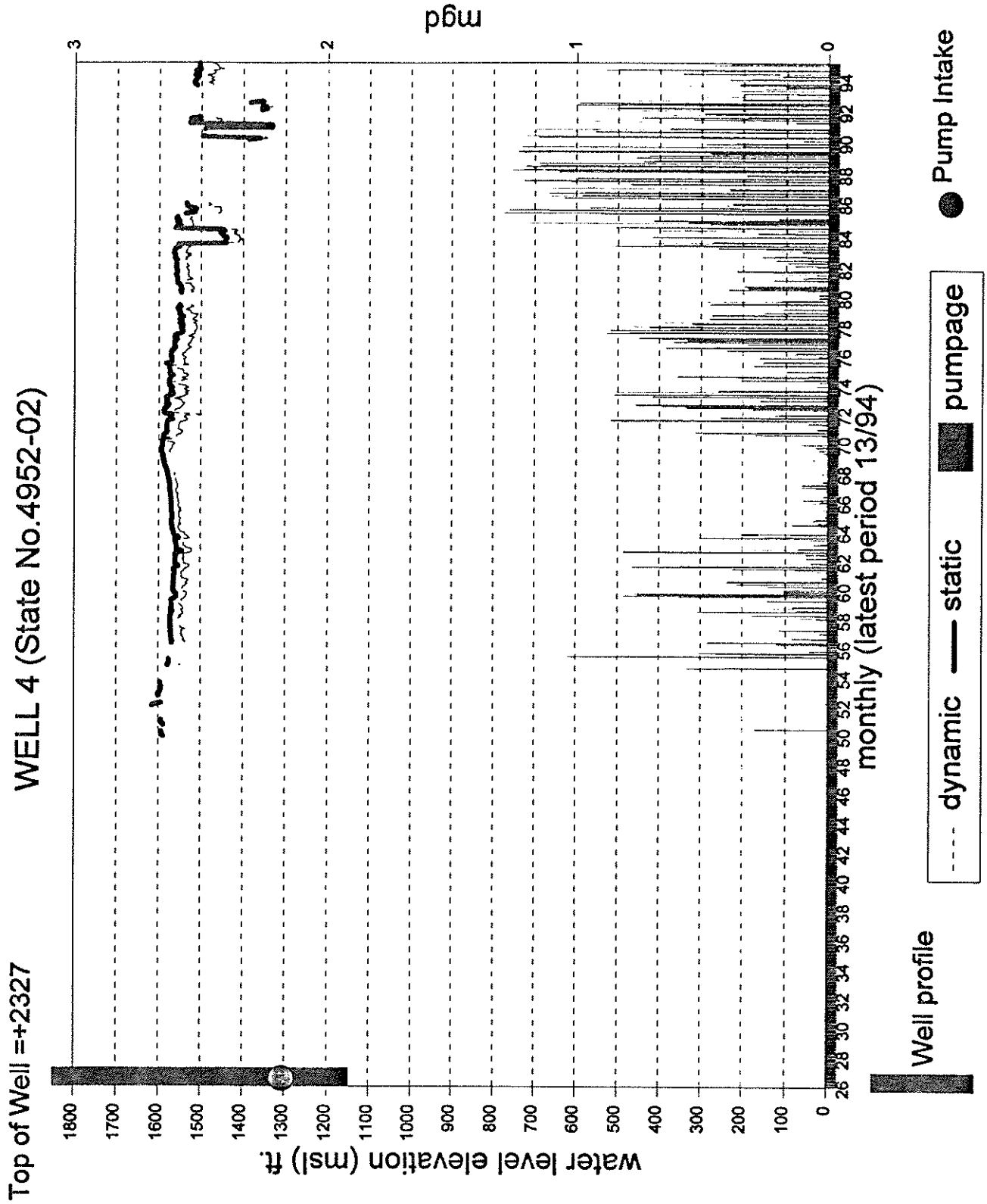


Figure 20. Well No.4952-02, Well 4 Historical Pumpage and Water Levels

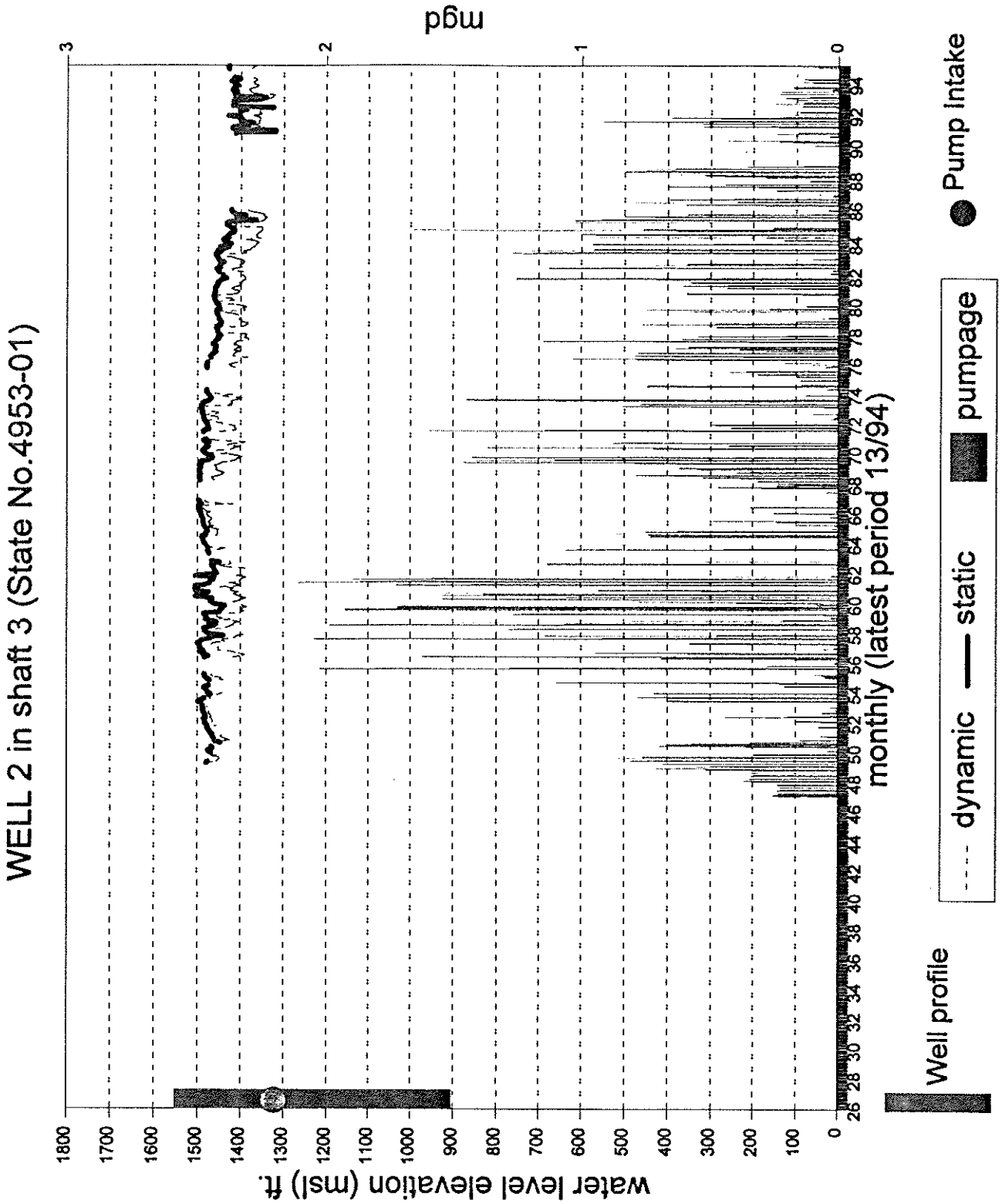


Figure 21. Well No.4953-01, Well 2 Historical Pumpage and Water Levels

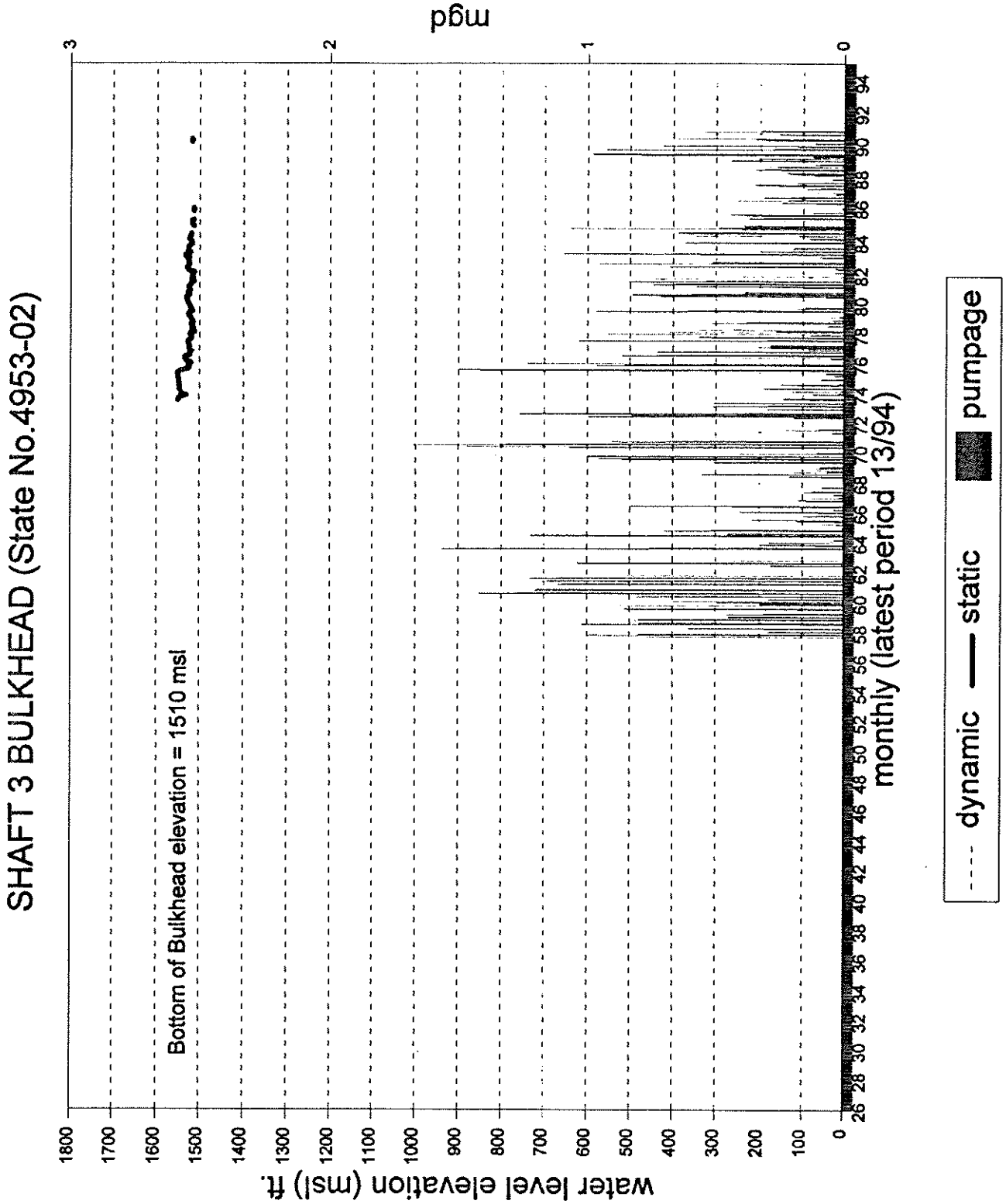


Figure 22. Well No.4953-02, Shaft 3 Historical Pumpage and Water Levels

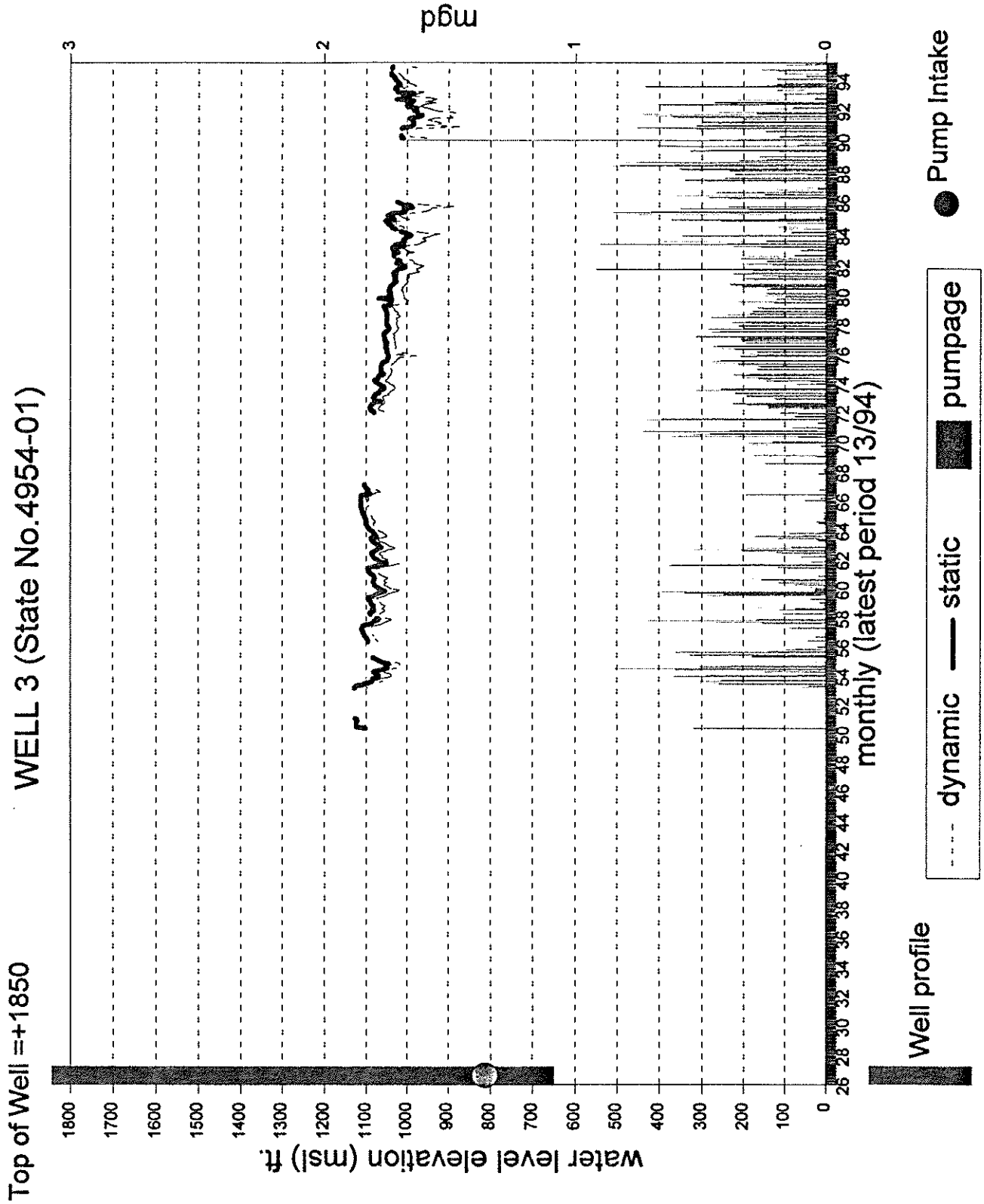


Figure 23. Well No.4954-01, Well 3 Historical Pumpage and Water Levels

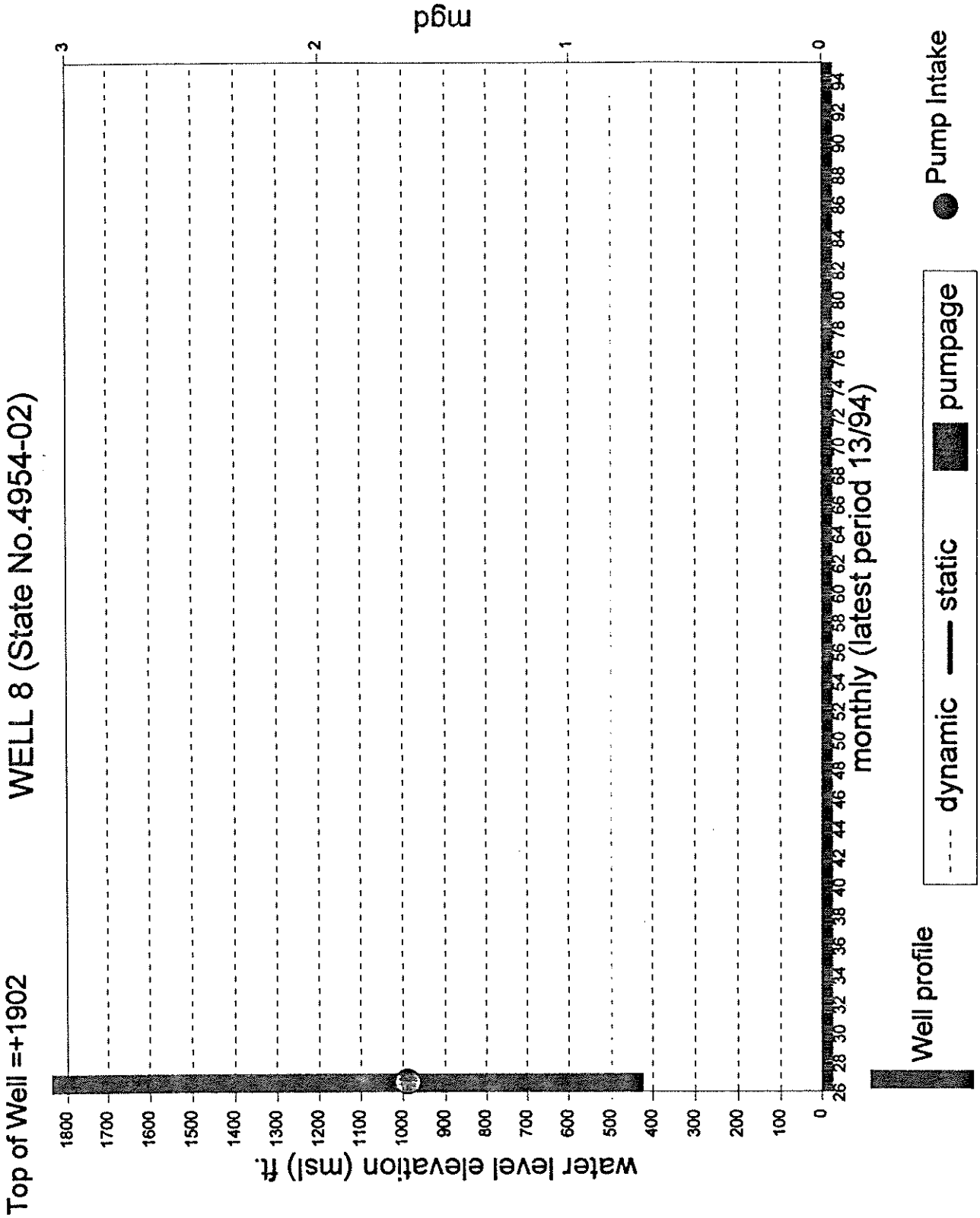


Figure 24. Well No.4954-02, Well 8 Historical Pumpage and Water Levels

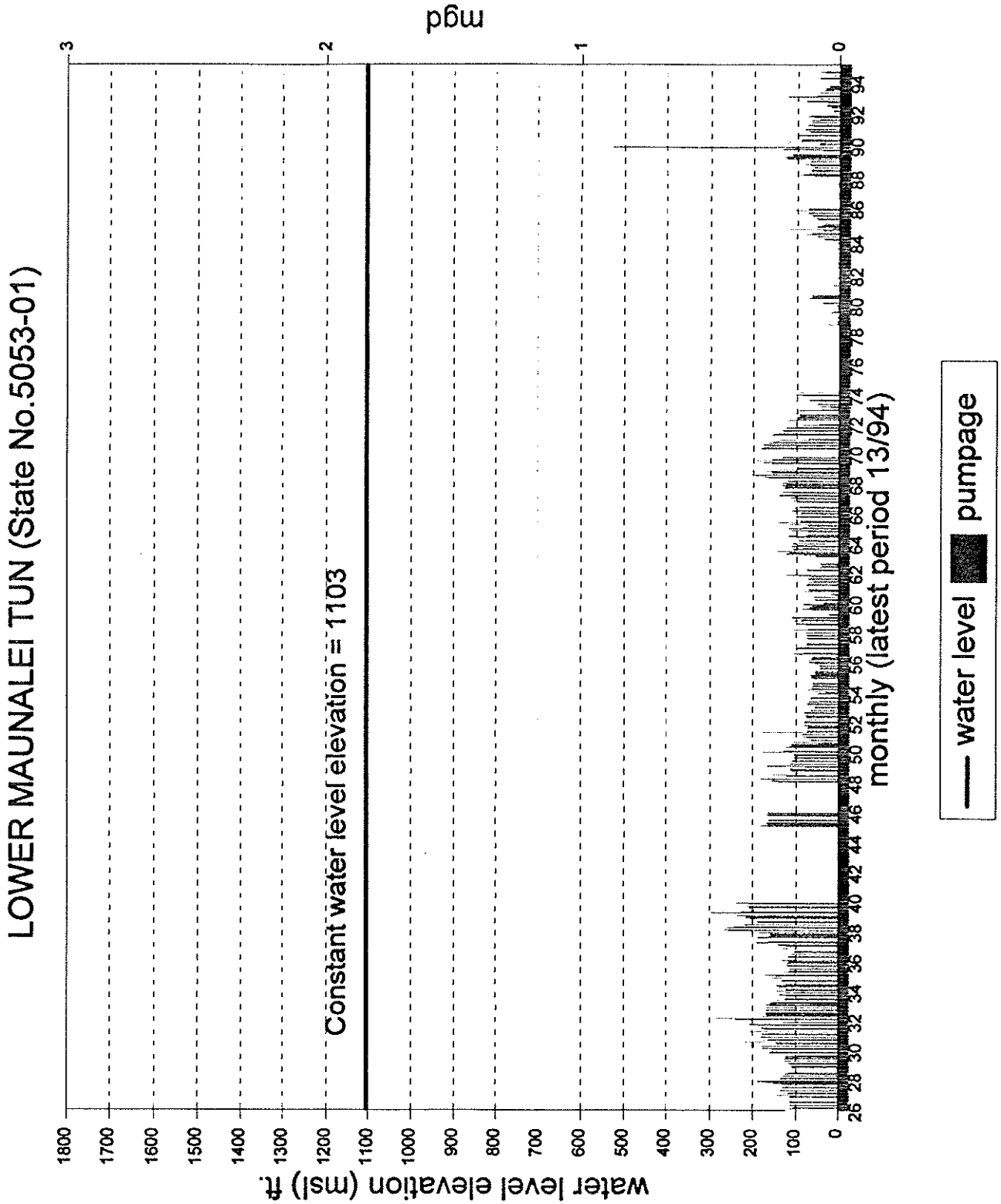


Figure 25. Well No.5053-01, Lower Tunnel Historical Pumpage and Water Levels

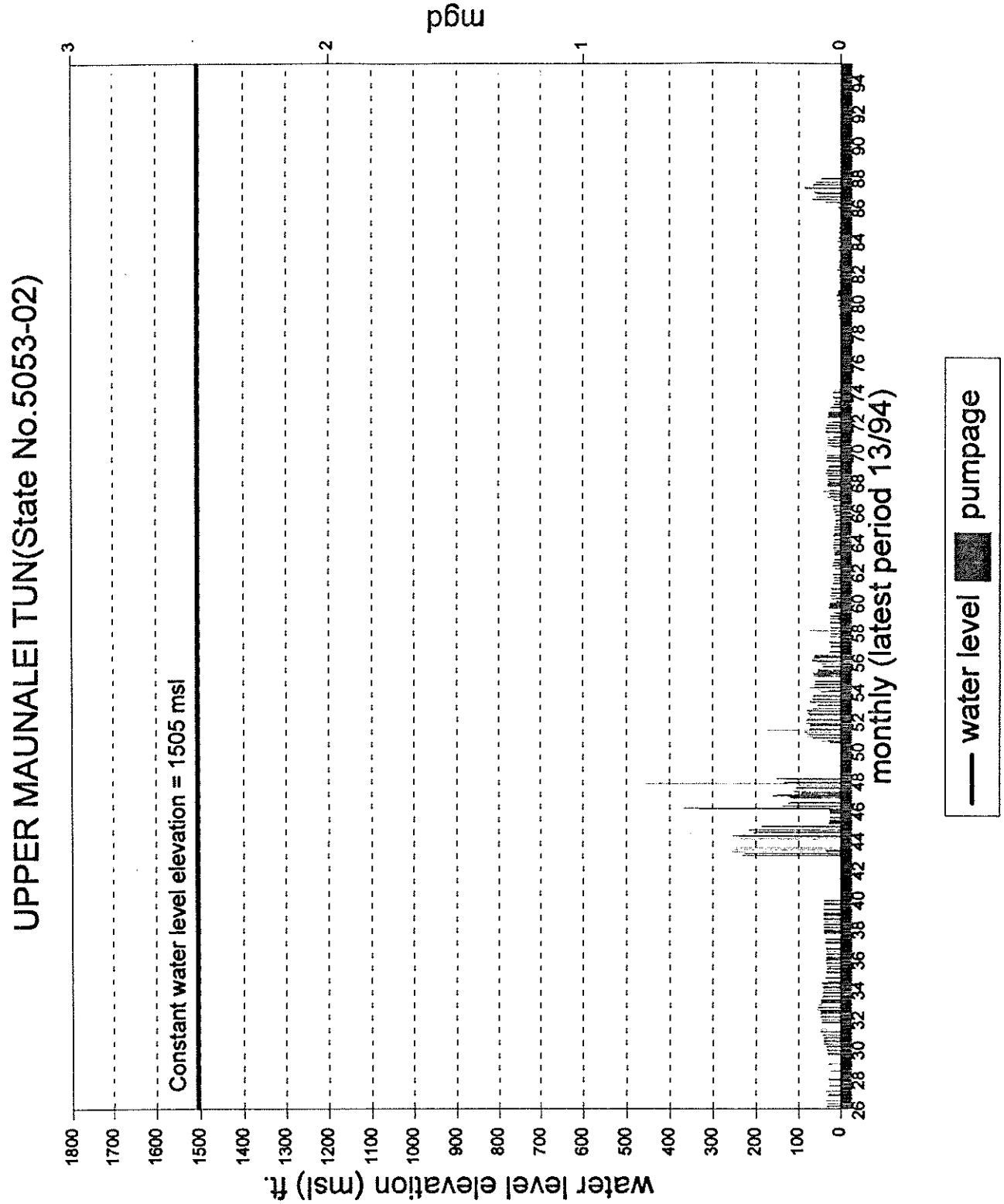


Figure 26. Well No.5053-02, Upper Tunnel Historical Pumpage and Water Levels

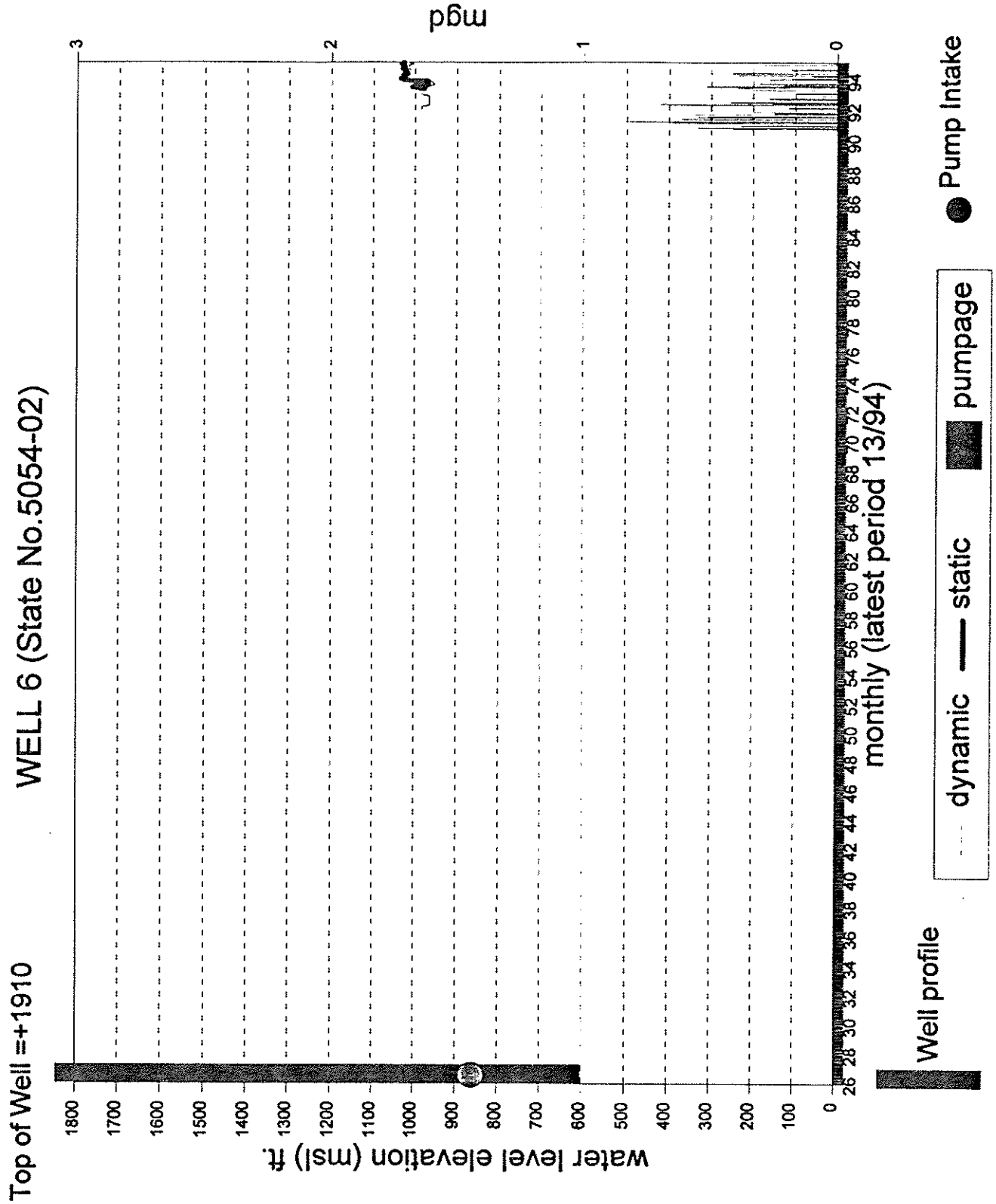


Figure 27. Well No.5054-02, Well 6 Historical Pumpage and Water Levels

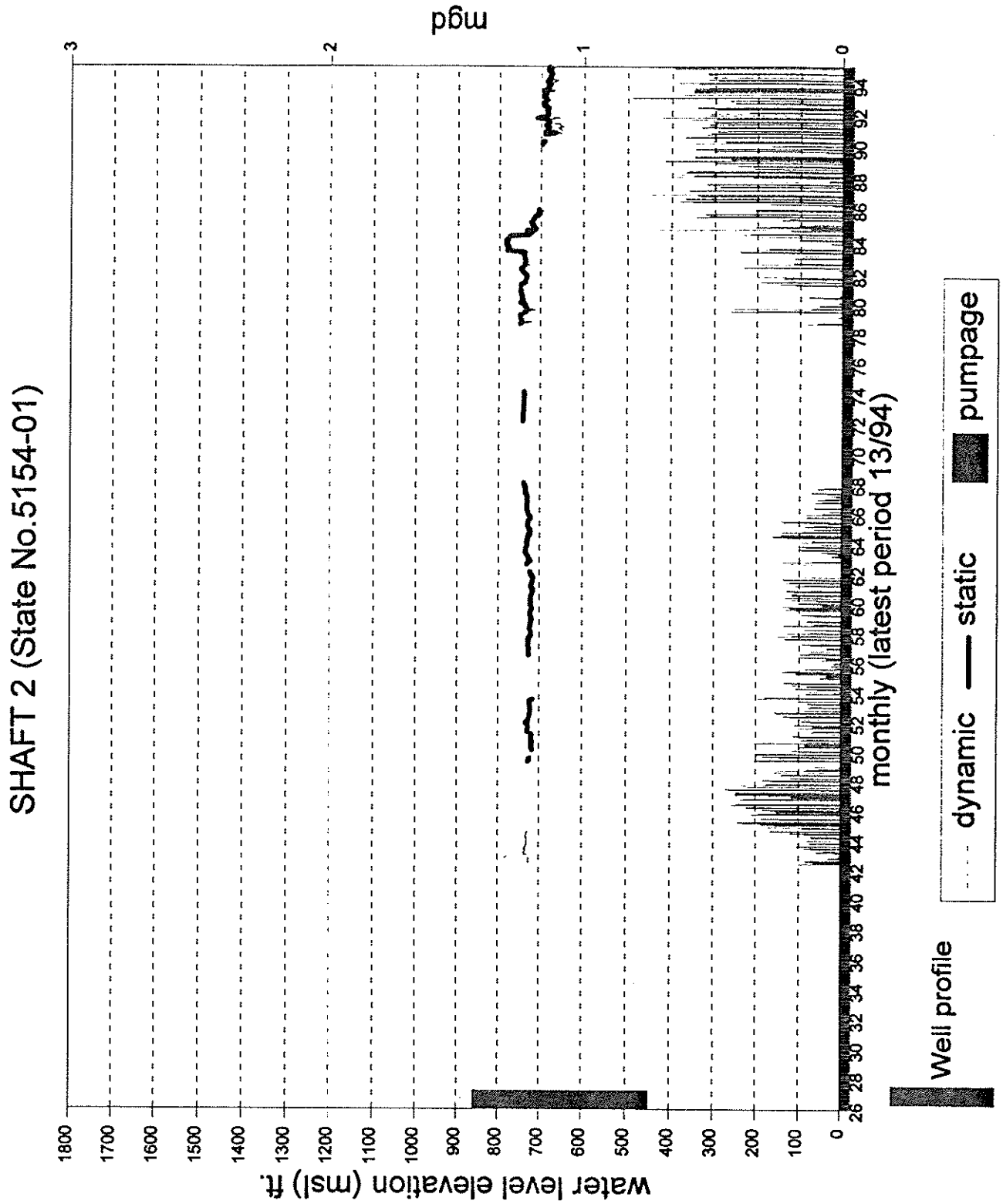


Figure 28. Well No.5154-01, Shaft 2 Historical Pumpage and Water Levels

Figure 29. Well No.5253-01, Shaft 1 Historical Pumpage and Water Levels

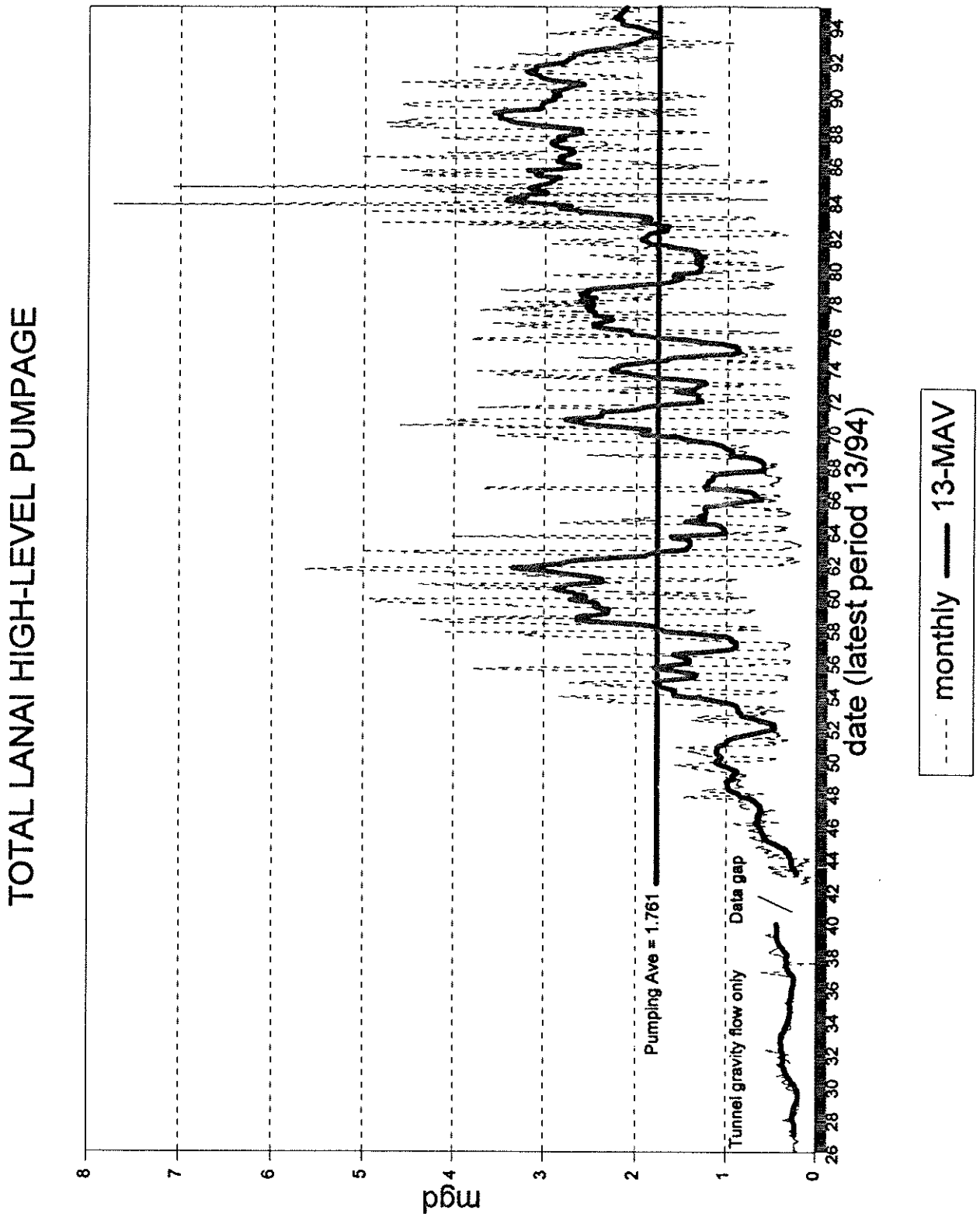


Figure 30. Total Historical Pumpage on Lana'i

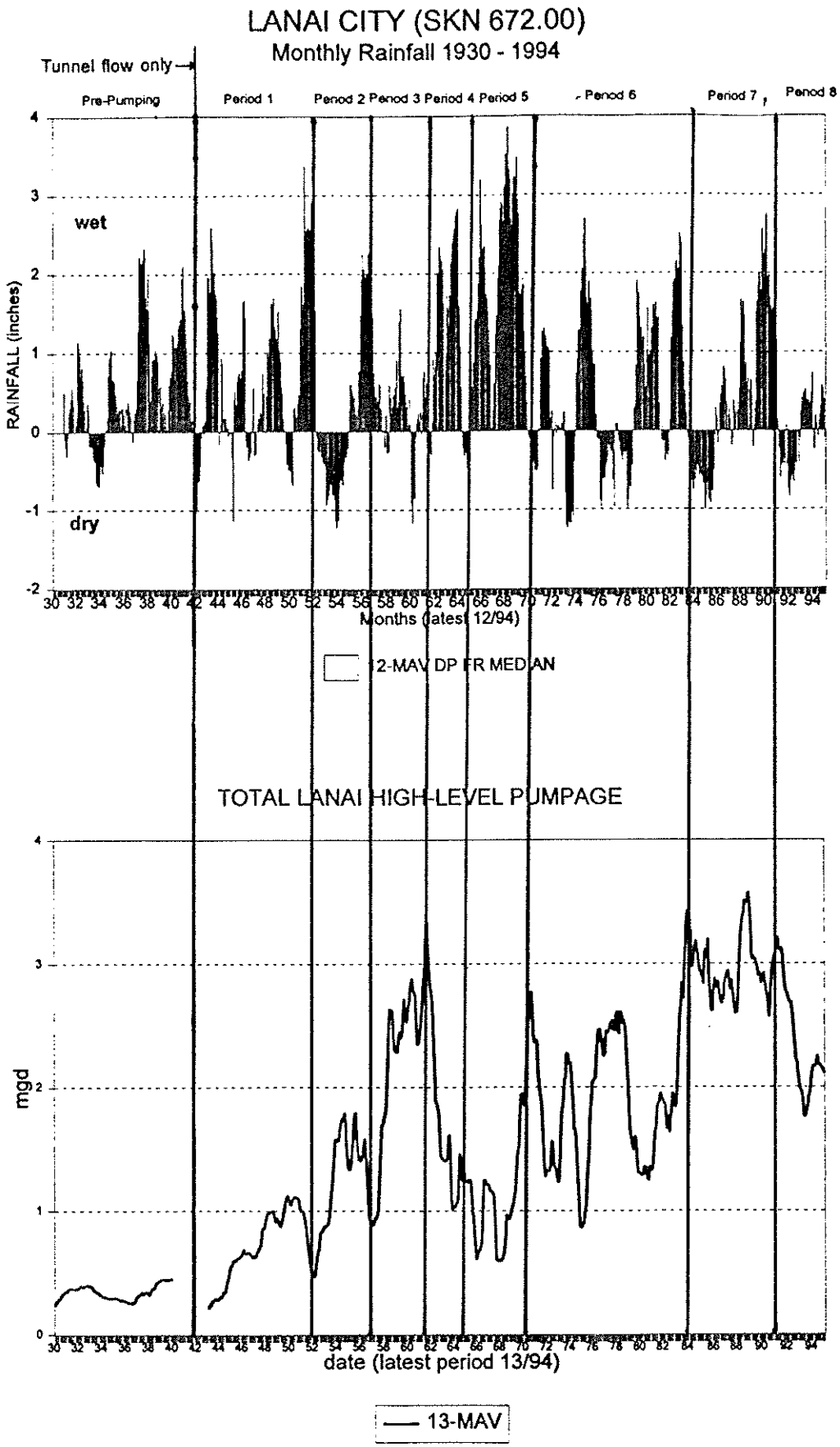


Figure 31. Selected Periods of Drawdown Levels on Lana'i

It is important to note that there are gaps in the data for both water-levels and pumpage. Part of the reason for the Maunalei sources' data gap in the late '60s through the late 70's were a combination of a flooding event in Shaft 2 and problems with the distribution system going up the pali (McCullough, personal communication, 4/22/95). Gaps in the data for other sources are simply indicative of the intermittent nature of pumpage and the lack of taking water-levels between pumping and non-pumping times. There are also spikes in the data which do not seem reasonable. Upon checking original recorded data with LCo. and consultant reports (Anderson, 1983) some of these spikes were corrected and such corrections are reflected in Figures 17 through 30. Other spikes could not be rectified. However, despite these problems with the water-level and pumpage data the overall historical data necessary for model calibration is good.

Water level data on Lana'i were and continue to be measured via pressurized airlines for both pumping and non-pumping conditions on continuous water-level charts. Pumps are operated on demand, hence they are turned on and off frequently. Pumping water-levels are reported as the lowest water-levels during a particular month. Pumping water-levels, or dynamic water-levels, always include some turbulent and frictional losses, which are primarily the function of well design, construction, and development and add to the theoretical drawdown in a well. Non-pumping, or static, water-levels are more representative of an aquifer's water-level response to stresses and are more important in the model calibration effort than pumping water-levels. This is because MODFLOW does not account for pumping well losses. Static water-levels on Lana'i were taken at least one-day after pumps were turned off although measurements after longer periods, sometimes several months, of pump shut-off are also common. The static water-level was and continues to be reported as highest water-level during a particular month.

There are definite general trends in the water-level data. Specifically, the rising trends in some of the wells in the absence of any long-term changes in rainfall patterns (Figure 10, pg. 23) and corresponding fluctuations in total pumpage (Figure 30, pg. 64) during the 1960's are curious. Bowles (1974) attributed the steady rising water-level trend in Shaft 2 (Figure 28, pg. 62) during the 1960's to reforestation and drainage programs initiated in the 1920's by Dole Plantation. The same may be said of Well 1 (Figure 18, pg. 52). From the early 70's to the late 80's a general decline in water-levels occurs between the ranges of 100 to 275 feet; a period of increasing pumpage. Since the early 90's, water-levels have recently been recovering due to the cessation of pumpage for pineapple which significantly lowered island-wide total pumpage.

Historic pumping stresses are to be imposed to the model after initial water-levels have been calibrated. Ideally, there should be periods where recharge, pumping and water-levels, show a steady-state like condition. This would allow the calibration of the model based on two (2) apparent steady-state conditions where effects of storage depletion from an aquifer have completed and can be ignored (i.e. the effective storage coefficient can be set to zero (0) and it is unnecessary to calibrate this parameter). Assuming the modeled long-term average recharge as steady-state, one can identify the second situation by comparing pumpage and water-levels alone. However, no clear steady-state condition can be identified for all wells simultaneously. Thus, the lack of two (2) definite steady-state situations island-wide makes it necessary to investigate transient situations to further evaluate the model. This entails calibration of the storage coefficient. Therefore, periods where significant trend changes in related rainfall, pumpage, and water-levels, were identified and resulted in eight distinct periods as shown in Figure 31, pg. 65. These same periods which define variations in pumping also define variations in recorded rainfall which can then be applied to the GIS recharge model to arrive at corresponding variations of recharge.

Selection of Numerical Code for Model

The numerical model chosen for the flow model is the three-dimensional flow finite-difference model MODFLOW (McDonald, & others, 1988). The code is public domain, well documented, and is referenced herein. An additional package to the original MODFLOW was used to simulate the barriers to horizontal-flow imposed by dikes and faults (Hsieh, & others, 1993). This augmentative code is also an open file report with the USGS and well documented. The advantage of Hsieh's work is that the MODFLOW model grid need not be changed to add these barriers. Additionally, the MODFLOW code performs mass balance (water-budget within MODFLOW separate from the GIS water-budget) and allows closure criterion for calculated water-levels.

The experience associated with MODFLOW's use was a major factor in selecting it for this preliminary model. MODFLOW has been the most widely used code by the USGS in modelling ground-water. One-hundred and sixty-five (165) calibrated models have been published by the USGS (Appel, 1994). There are other numerical models which are available but their use has been limited. For example, SHARP (Essaid, 1990) is a freshwater and saltwater flow model which could be used for Lana'i. However, there are limitations in its grid construction when compared to MODFLOW and it is usually used for studies where the interface near the shoreline is important. Since the high-level ground-water source is of primary concern, the shoreline interface between fresh and salt water is not of primary concern, and it can be used as a three-dimensional model, MODFLOW is considered the more efficient and appropriate model to use. Additionally, SHARP has only eight (8) documented calibrated models (Appel, 1994) as compared to MODFLOW's 165.

Basically, MODFLOW solves for the fundamental three-dimensional (3D) movement of ground-water by the partial differential Equation eq.(11), which is defined as:

$$\frac{d}{dx}\left(K_x\frac{\partial h}{\partial x}\right)+\frac{d}{dy}\left(K_y\frac{\partial h}{\partial y}\right)+\frac{d}{dz}\left(K_z\frac{\partial h}{\partial z}\right) = S_s\frac{\partial h}{\partial t}-F \qquad \text{eq.(11)}$$

where:

K_x, K_y, and K_z = hydraulic conductivity along the x, y, and z axes (L/t)

h = potentiometric head (L)

F = net volumetric flux per unit volume of aquifer per unit time (1/t)

S_s = Specific storage of porous material (1/L)

t = time (t)

Equation eq.(11) is derived by combining Darcy's law, equation eq.(1), pg. 14, and continuity considerations for a constant density fluid where flow into and out of the system is equal. Anderson (& others 1992) describes this fundamental equation as the flow system viewpoint where one is not concerned with identifying individual aquifers and confining beds *per se* but in constructing the 3D distribution of heads, hydraulic conductivities, and storage properties everywhere in the 3D system. A description of MODFLOW's finite difference equations and numerical methods used to solve Equation eq.(11) between each cell is too technical for this report but is well documented (McDonald & Harbaugh, 1988).

Numerical Model Construction

The goal of any numerical model construction is to represent the important conceptual properties of the study area in mathematical terms which can be solved numerically. To do this one requires the governing mathematical equations, or equation eq.(11), pg. 67, boundary conditions that mathematically describe how water gets into and out of the aquifer, and known initial conditions. In constructing the Lana'i numerical model one concept was kept in mind at all times; make the model as simple as possible yet capture the important properties, and no simpler. Although this limits the flexibility of the model, this approach is thought to produce the most defensible model. This also limits the "subjectivity" of the model by forcing the modeler to use one consistent approach.

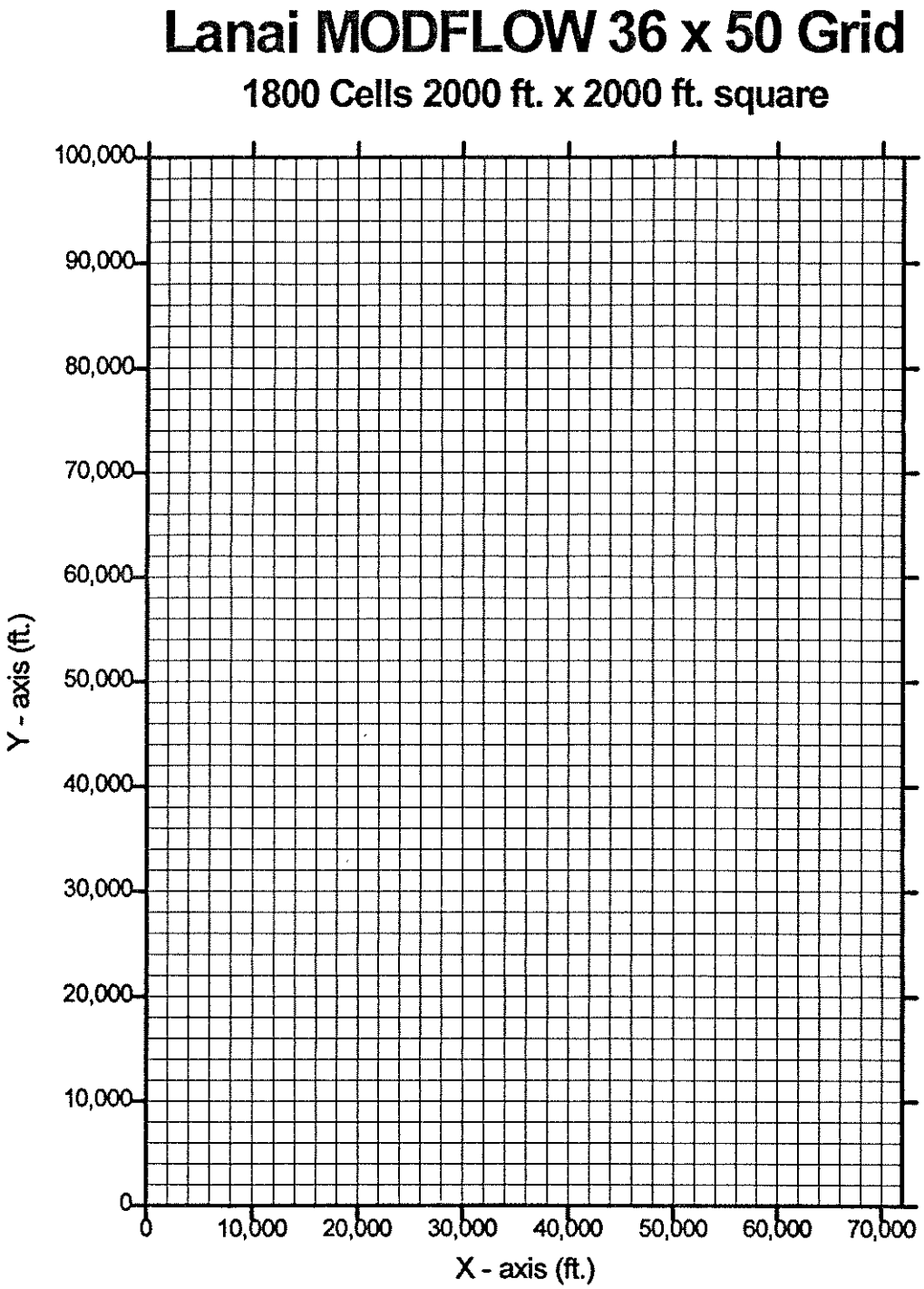
Grid

The grid is the starting point of the model construction in that it provides the consistent framework to which all parameters must relate. The simplest grid to construct is one where individual cells are of **uniform** size which adequately cover the entire area of interest. Since the model is at a regional scale cells should be on the order of many hundreds, or a few thousands, of feet square. A cell size of 2000 ft. by 2000 ft. square, which covers an area of 1/7 mi^2, was chosen to discretize the island. This resulted in a total grid size of 1800 cells (50 x 36) which encompasses the entire island of Lana'i (See Figure 32). For convenience, the grid was oriented along the relatively straight northeastern coast of Lana'i, which spans from the mouth of Maunalei Gulch to Halepalaoa Landing, and such that wells were located in separate cells. The total grid size and nodal spacing on the order of thousands of feet place the model in the regional scale category according to Anderson & Woessner, (1992). This is an important feature since many different local or site characteristics that may reside solely within one cell will not be addressed by this model.

Grids in MODFLOW are finite difference which can be either block-centered or mesh-centered. Block-centered grids places the flux boundaries at the edge of the cells and the node of the cell at the center, whereas the mesh-centered grid places the flux boundary at the nodes and not the cell edges. To utilize the horizontal-flow barrier (HFB) package of MODFLOW the block-centered grid was chosen to use cell edges as flux boundaries.

2-D Rational

As shown in Figure 32, pg. 69, the model is only a single layer which effectively makes this Lana'i numerical model two-dimensional (2D). This is because for any single unconfined layer, MODFLOW incorporates Dupuit assumptions which ensure horizontal-flow by requiring no change in head with depth. This effectively removes the K_z term, or any vertical flow, from equation eq.(11), pg. 67 and reduces the problem to one of 2D. MODFLOW can still solve 3D distribution of heads, but multiple layers are necessary. Since the initial assumption was that at the regional island scale the aquifer would behave isotropically and the model is preliminary, multiple layers were not made. Again, the purpose is to keep the model simple as possible. Because of this approach, water-levels would be averaged over 1000's of feet of depth and the model will only be a good regional approximation if calibrated.



Note: Y - axis in MODFLOW has origin at the top rather than the normal cartesian display as shown.

Figure 32. Single Layer MODFLOW Grid 50 x 36 Mesh with 2000 ft. square cells.

Mathematical Boundary, Internal, & Source/Sink Conditions

The way the conceptual hydrologic boundaries and stresses correspond to the mathematical boundary, internal, and source/sink conditions in the Lana'i numerical model are described in the following paragraphs. It is important to note that setting boundary conditions is the step in numerical modelling most subject to serious error (Franke, & others, 1987). The boundaries in this model are physically based; the head around the shoreline is equal to zero; the top is the water table; and the bottom is estimated but poorly known. The reader should note that references to internal boundaries in this report are also commonly referred to as special zones.

Normally, when speaking of boundary conditions in a numerical model the modeler is addressing the mathematical boundary conditions which define the extent or domain of the entire modelled area. These can be thought of as the perimeter, bottom, and top of the saturated ground-water between which all flow occurs within the grid layer. When these mathematical boundary conditions are specified then one may solve the partial differential ground-water flow equation eq.(11), pg. 67 through simultaneous algebraic equations in the numerical model (Franke, & others, 1984). The three (3) major types of mathematical boundary conditions are:

(1) *Specified head;*

(2) *Specified flow; or*

(3) *Head-dependent flow* (some combination of (1) & (2)).

Such boundaries constrain the problem and make solutions possible. The freshwater flow at the coast does not extend for any significant distance offshore. Therefore, the perimeter of the grid is a *specified flow* type where no flow occurs. Also, the bottom of the freshwater lens is assumed to be an idealized constant which is not physically correct in location but is correct in establishing streamlines along the bottom of the aquifer. These streamlines go towards the ocean and provide a datum for the model to estimate aquifer $\boldsymbol{T}$ values based on given $\boldsymbol{K}$ values. This *specified flow* boundary of no-flow across the bottom of the model was set at -400 ft. msl based on geophysical resistivity work by Swartz (1940) which identified the depth of salt-water/freshwater break in a cross-section of the island. As stated earlier, the maximum aquifer bottom elevation was estimated at -948 ft. msl by one station. Due to the general lack of caprock around the island and a thick basal lens, lens depth must decrease to approximately zero at the coast. Therefore, the average depth between the coastline and the maximum aquifer depth was considered to be reasonable assumption for constant bottom depth ($(948+0)/2 = 424 \approx 400$ ft.).

It is clear that grid perimeter and bottom of the grid layer for the Lana'i model are no-flow mathematical boundaries. The top of the model, or the water table, is a different matter. Since the Lana'i numerical model uses Dupuit assumptions, where all flow is horizontal in the 2D single layer representation, flux across the water table is treated as a source, lumped in the $\boldsymbol{F}$ term in equation eq.(11), pg. 67, rather than a boundary condition (Anderson, & others 1992). Thus, the model's mathematical boundaries are no-flow on five (5) with recharge occurring as the sixth side (water table).

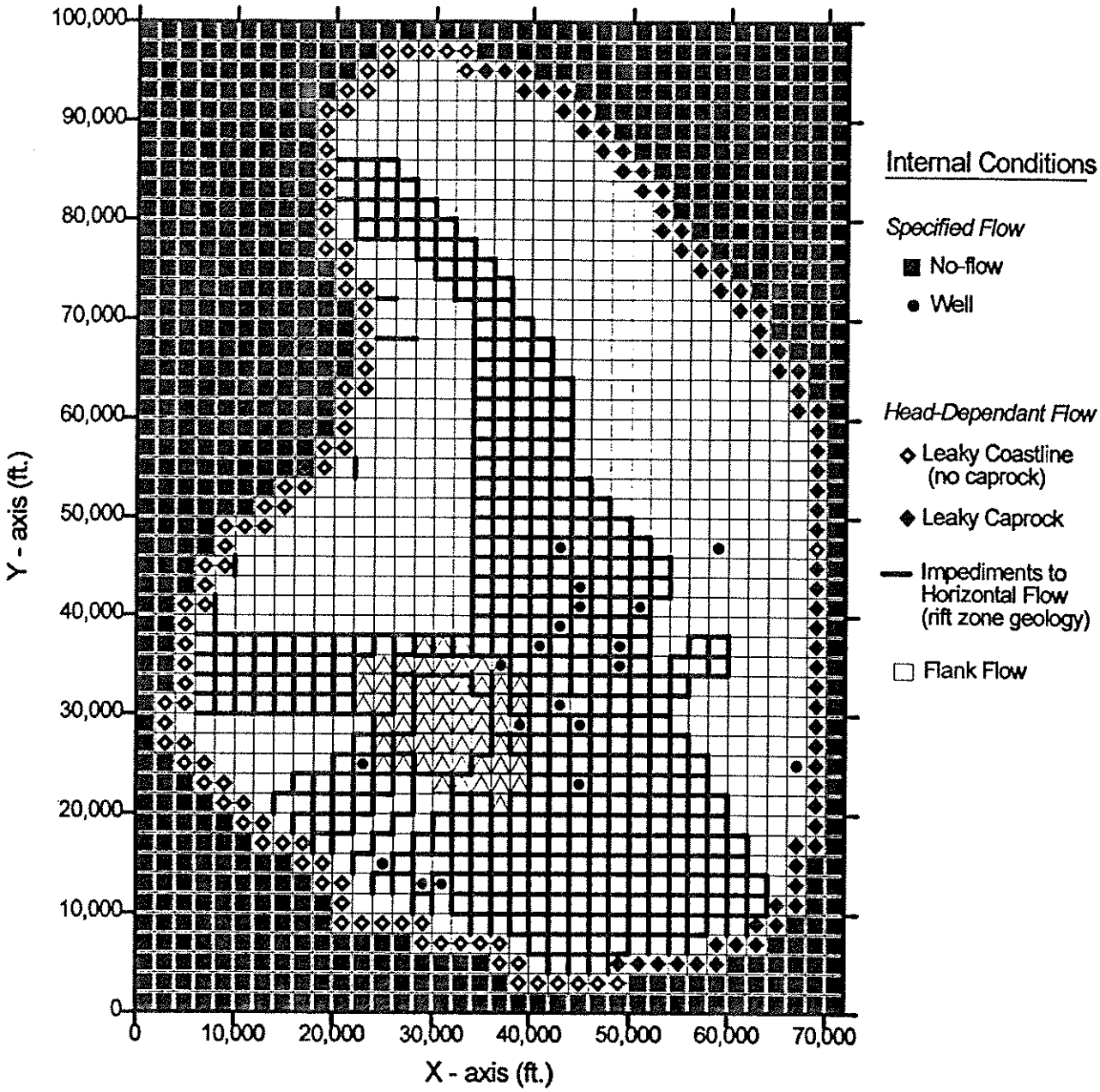
Internal model conditions are not to be confused with mathematical boundary conditions. The relevant physical or hydraulic hydrologic boundaries for Lana'i are the Pacific Ocean coastline which surrounds the entire island, a northern region of low permeability along the coast, the three rift zones which are manifested by observed dike and fault boundaries, the water table (computed by MODFLOW), the tunnel sources, and even flank flows. In the Lana'i numerical model, these conceptual hydrologic boundaries are types of *internal conditions*, or boundaries, which are different than the mathematical boundary conditions described in the previous paragraphs.

The Pacific Ocean coastline is represented by surrounding the island with the equivalent of a leaky streambed which is an *internal head-dependent flow condition.* The river or drain packages in MODFLOW calculate aquifer heads necessary to simulate seepage from the aquifer to a surface water body (the ocean) with a constant stage. These packages are identical although the river package allows flow to and from the surface water body whereas the drain package allows flow only to the surface water body. The river package, RIV, was chosen over the drain package to allow for ocean intrusion at the coast. Normally, the river package is used to represent streams but can be used to represent the equivalent leaky type of boundary where flow through the coastal toe of the basal lens must occur. The ground-water must pass through a thin region near the shore which approximates the toe of a basal aquifer which does not extend past the shoreline for any great distances. Therefore, a thin band of this leaky *internal head-dependent flow condition* surrounds the entire island as is shown in Figure 33, pg. 72. A total of one hundred and sixty-four (164) cells were identified to form a single cell wide band around the island. All cells ocean side of this boundary are not part of the island ground-water system and were given the *internal specified flow condition* of no-flow. The internal river boundary is divided into the two (2) regimes of a flank flow permeable southern coast and a less permeable alluvial northern coast. The demarcation points for these two regimes are Palahinu Point and Naha, which corresponds to Stearns (1940) description of coastal alluvial deposits and is twice the length of Adams (& others, 1973) study regime for the alluvial beachrock on the northern coastline. This stretch of northern shoreline is assigned a lower hydraulic conductivity than the southern shore with the exception of Lae Hi Point which happens to be a basaltic outcrop. These internal conditions corresponding to a caprock like condition impact a total of seventy-two (72) cells in the numerical model and are also shown in Figure 33, pg. 72.

The boundaries associated with three (3) major rift zones for Lana'i are also *internal head-dependent flow conditions.* The combination of dikes, faults, and rock contained within Lanai's rift zones produce a honeycombed effect as these geologic features incise the flank flows of the island and intersect with each other within the major rift zones. The horizontal-flow barrier (HFB) package in MODFLOW provides and easy way to model these conditions. A total of eight hundred and ninety-five (895) cell walls were made into effective internal HFB conditions. It is important to remember that these internal conditions represent the net effects of many unseen geologic features and are not actual individual boundaries.

The Lower and Upper Maunalei Tunnels are modeled as *internal head-dependent flow cells* through the drain package. Finally, all other pumping wells are sink terms in the model. One important issue with wells is that although they are located in the model's individual cells they are only approximately located at the central node in each cell. In addition to this approximation, interpolation errors between the grid nodes in this regional numerical model may be as much as 10 ft. (Anderson, 1988).

Lanai MODFLOW 36 x 50 Grid



Note: Y - axis in MODFLOW has origin at the top-left rather than the cartesian display as shown.

Areal Extent of High-Level Aquifer as defined by cells surrounded by impediments to horizontal flow = 57.4 sq. mi.

Figure 33. Final Boundary Conditions for the Lana'i Numerical Model

Source/sink terms are basically the net flux, F, applied at each cell node in the model in accordance with equation eq.(11), pg. 67. The recharge, R, array portion of this net F term is the result of the GIS water-budget model discussed earlier and is a source term. The individual cell value results were constructed by merging the GIS results with the model grid and inputting the results into the recharge package of MODFLOW. Recharge values were in inches/day over for each cell area in the model grid which produce a cell volumetric inflow rate. Once initial water-levels have been calibrated then pumping stresses can be imposed easily for each well by using the well package of MODFLOW. Pumping stresses in the Lana'i numerical model are all sink terms which mean they take water out of the aquifer system.

Hydraulic Parameters

Previous discussions of the governing hydraulic equations for Darcy's Law, equation eq.(1), pg. 14, and transmissivity, equation eq.(2), pg. 15, are not repeated here. Before discussing additional and individual hydraulic parameters, it is again necessary to clarify a major concept regarding their values. As discussed earlier, and in general, the many sources of error associated with aquifer pumping tests dictate that values obtained are not absolute nor necessarily accurate. Such values are more appropriate for local conditions and individual well performance rather than island-wide regional hydraulic behavior. Thus, the actual heterogeneity in the real world cannot be entirely dismissed. However, these hydraulic tests do provide a 'ballpark' starting point and reasonable range to begin the parameter estimation process for an assumed or 'effective' homogeneous situation which represents the heterogeneous situation. It is important not to label or confuse resulting 'effective' homogenous hydraulic parameters estimated by the numerical analysis with the 'actual' hydraulic parameters in the very heterogeneous real world. It should also be understood that rules governing the estimation of these 'effective' homogeneous parameters are not well defined (Smith, & others, 1993).

For the Lana'i numerical model there are four basic hydraulic parameters which are varied in the calibration process. These are the global flank flow horizontal hydraulic conductivity, or permeability, K_h, the coastal streambed conductance term, SC, the horizontal-flow barrier (HFB) hydraulic characteristic, $HYDCHR_u$., and the tunnel drain conductance term DC.

Global K_h can be described as the average effective hydraulic conductivity in the flank flow lavas. Although there is ample evidence that homogenous and isotropic conditions do not exist at the local scale The average K_h from existing pumping test data is 18.3 ft/day(Table 13, pg. 50). As stated earlier, it is known that pumping tests occurred in the rift zone and actually encountered dike, fault, or both boundaries. The intrusive boundaries cause greater drawdown during a pump test than would otherwise be observed which results in lower computed K_h values for flank flows. It is difficult to determine to what degree pump test K_h values would increase to correct for boundary encounters but it would not be unreasonable to assume flank flow K_h values are within the range of tens (10^1) to thousands (10^3) of feet per day. The K_h value may be lower in the Palawai Caldera region than other parts of the island as evidenced by pump test results (see Table 13, pg. 50) but this relative difference is less than an order of one (1) magnitude.

Streambed conductance (coastal leakage cells in this model), SC, is defined in MODFLOW as:

$$SC = \frac{Klw}{m} \qquad \text{eq.(12)}$$

where:

SC = Streambed conductance (L^2/t)
K = hydraulic conductivity (L/t)
l = length of cell (L)
w = width of cell (L)
m = depth of stream bed layer (L)

In the numerical model, the length, l, and width, w, are constant for all cells, including the coastal cells, at 2000 ft. which results in an area of 4,000,000 sq.ft. The depth and thickness of the coastal streambed was defined by setting the bottom of the river bed at -10 ft. msl in the model which is estimated to be the thickness of the freshwater lens in these coastal cells. The RIV package requires a constant water-level to be maintained in the stream/ocean coastline itself, which is sea level, or 0.0 ft. msl. The resulting stream bed hydraulic conductivity, K, must then be estimated. The overall the SC term is inherently empirical (McDonald, & others, 1988) and must be calibrated. Given the lack of a caprock type formation along the southern coast, the streambed hydraulic conductivity, K, in eq.(12), is set equal to flank flow K_h of any particular calibration run. Given the caprock or beachrock coastal geology along the northern shore, the streambed hydraulic conductivity, K, in eq.(12) for each cell must be calibrated to yield observed water-levels and will be lower than the flank flow K_h of the same corresponding calibration run. Typical K values for other windward type caprock have been estimated to range between 0.1 to 0.08 ft/day (Eyre & others, 1986, Yuen, 1994).

The horizontal-flow barrier (HFB) boundary package for MODFLOW requires a hydraulic characteristic input which is defined as:

$$HYDCHR_u = \frac{K_{hb}}{w} \qquad \text{eq.(13)}$$

where:

$HYDCHR_u$= Unconfined aquifer HFB hydraulic characteristic (1/t)
K_{hb} = hydraulic conductivity of the horizontal-flow barrier(L/t)
w = width or thickness of horizontal-flow barrier (L)
note: the barrier is vertical and impedes flow in the horizontal direction.

Equation eq.(13) is valid for MODFLOW layer types defined as unconfined. It is somewhat empirical since one does not know the actual width or actual 'effective' width of a HFB. Therefore, $HYDCHR_u$ was calibrated to simulate water-levels. Since we know that the K_{hb} term must be lower than the global flank flow K_h term, the w term could be a significant portion of the width of the cell, or 2,000 ft., and the K_{hb} term could be several orders of magnitudes lower than K_h, the $HYDCHR_u$ term should be as low as 10^{-4} or less.

There is no general formulation presented in MODLFOW for the drain conductance term, ***DC***, like the other modeled hydraulic parameters. This is due to the difficulty in quantifying all the parameters which affect flow to a drain. Therefore, it is truly a lumped proportionality parameter. However, three (3) processes affecting drain flow are discussed in MODFLOW and are described through equation eq.(14) as follows:

$$DC = CF \cdot K_D \cdot WL \qquad \text{eq.(14)}$$

where:

DC = Drain conductance (dimensionless)
CF = head losses from convergent flow to the drain
K_D = hydraulic conductivity or material around drain
WL = head losses from flow through the drain wall openings, length, etc.

Like ***SC***, ***DC*** is empirical and perhaps even more so given the fact that turbulent flow losses are to be accounted for in this term. However, if one knows the flow to the drain then ***DC*** can be calibrated for that flow. Fortunately, sufficient Maunalei tunnel flow data is available.

As a final note, the storage coefficient, ***S*** (see equation eq.(3), pg. 16), is set to zero (0) in all initial tunnel flow and water-level computer runs since we are calibrating to an assumed steady-state conditions. In transient situations it will be necessary calibrate ***S*** to match transient water-levels.

Solution Techniques

Of the two basic solution techniques available in MODFLOW to solve the large matrices-which are developed in making a model, the Strongly Implicit Procedure Package (SIP) was used throughout the computer runs for this study. SIP utilizes backward difference approximation, or implicit difference formulation (Wang, & others, 1982), to solve the system of linear equations which approximate the analytical solution to equation eq.(11), pg. 67 for each cell. This technique is favored since it always numerically stable, i.e. errors introduced at any time diminish progressively at succeeding times. The specific technique is not covered here but is well documented in MODFLOW (McDonald, & others, 1988). An alternative solution technique called the slice successive over-relaxation (SSOR) is available but was not used.

Numerical Parameters (closure, seed, acceleration, etc.)

Various numerical parameters were used for error checking and to help speed convergence of the model. The closure criteria was set at 0.001 ft. maximum absolute value of head change and was constant throughout all simulations. Seed factors were always calculated by MODFLOW. The acceleration factor used was generally one (1) although model estimation sensitivity during later simulations necessitated smaller positive values (down to 0.1) to smooth solution closure and speed convergence.

Calibration Targets (tunnel flow, initial water-levels, transient water-levels)

Generally, steady-state, or equilibrium, calibration targets need solid definition for a meaningful calibration effort. The steady-state targets are those conditions where the mean water-levels of the system during a representative climactic period show no increasing or decreasing long-term trends. Ideally, many observation wells could be put in and ground-water-levels recorded many years prior to any pumpage to establish some stead-state distribution of ground-water-levels. In reality, wells are normally pumped immediately after they are drilled since the expenditure of monies for drilling was justified by the potential utility of supplying water needs in the first place. Thus, the historic record must be carefully searched to identify appropriate target values.

Fortunately for Lana'i, there is a period of steady-state pumping and initial water-levels. Aquifer water-levels for the first ground-water sources, the Lower and Upper Maunalei Tunnels are difficult to ascertain except that they are higher than the tunnel floors. These tunnels had been producing ground-water for at least twelve (12) years prior to the drilling of later sources and may have affected the later sources' water-levels. However, this seemingly unfortunate circumstance actually provides a steady-state situation. The steady-state calibration target was identified as the established base flow from the tunnels and the corresponding water-levels for Shafts 1 & 2 which were not pumped significantly during this period and serve as observation wells. Other than this scenario, there is no other definite period of constant water-levels with constant recharge, pumping, and ground-water-levels in the record.

The establishment of baseflow from both Maunalei tunnels is difficult given the historical record. Although Stearns stated that the Lower Maunalei Tunnel was 'driven' in 1911, data recordation for the tunnel flows did not begin until 1926. However, Lloyd (1975) stated that water development of the gulch began in 1923. Whatever is the actual case, the tunnels had at least twelve (12) years in which to deplete storage and reach base-flow or steady-state conditions. On Oahu, the maximum time to establish based flow conditions for the Waiahole Ditch tunnels was approximately seven (7) years from Takasaki's & Mink (1985) estimation of monotonic decay periods. Therefore, it is assumed that the Maunalei tunnels probably had reached steady-state base flow conditions before other Lana'i wells were drilled and pumped. Using this reasoning, the average flow for the Maunalei tunnels during 1926 to 1939 was deemed to be an appropriate value to use. One could argue that perhaps the data from 1933 to 1939 would be an even better period of flow use since this would filter out the initial decay period of tunnel flow to get a better base flow average. However, considering the rainfall departure, as shown in Figure 10, pg. 23 & Figure 11, pg. 24, for the two different periods it can be seen that the 1933 to 1939 period is a much wetter period than the longer 1926 to 1939 period. Not surprisingly, the average tunnel flow for 1933 to 1939 is slightly higher than the average flow for 1926 to 1933 for both tunnels. This indicates that the tunnel flows are sensitive to changes in climactic conditions and recharge. Therefore, the longer period was considered closer to the average climactic conditions on Lana'i than the 1933 to 1939 period and is somewhat more conservative. These tunnel flow calibration targets values are shown in Table 14, pg. 77. These target tunnel flows are primarily achieved by altering the ***DC*** parameter from equation eq.(14), pg. 75 but are also dependent on the inland ground-water-levels which, in turn, are defined by the various other hydraulic parameters already defined.

In addition to tunnel base flow calibration, observed ground-water-levels for existing non-pumping wells or initial ground-water-levels observed for wells drilled after the tunnels must also be calibrated. This results in a calibration effort which must simultaneously match tunnel base flows and initial ground-water-levels in selected wells to achieve the calibrated steady-state situation. ground-water-level data from Shafts 1 & 2 provide the best estimate of initial water-levels for the steady-state period, at least for the windward side of Lana'i. Although initial water-level data is limited to these two (2) sources and not gathered on Lana'i under ideal conditions (windward only, and during a higher rainfall period), it is the best situation available for steady-state conditions. However, this situation can be helped by a ranking, or weighting, of other initial water-levels encountered. The resulting ranking of initial water-levels is more or less chronological since stresses imposed on the aquifer vary through time in concert with the construction of the wells. The calibration targets for initial water-levels are shown in Table 14.

Table 14. Calibration Targets and Rank of Importance

Rank	Year Initially Drilled	Well Name	Well No	Grid Location		Initial Water-Level (ft. msl)	1926-1939 Average Q (mgd)
				MODFLOW (row, col)	Plot x,y (1000 ft.)		
1	1900	Gay Well A	5149-01	38, 34	67, 25	2	[a]na
2	1911	Lower Tunnel	5053-01	32, 25	49, 37	1103	0.261
3	1911	Upper Tunnel	5053-02	33, 25	49, 35	1500	0.064
4	1918	MH Tunnel	4852-01	39, 24	47, 23	(dry)<2700	na
5	1920	Gay Tunnel	4853-01	37, 22	43, 27	(dry)<1920	na
6	1924	Waiapaa Tunnel	4952-01	36, 24	47, 29	(dry)<2220	na
7	1936	Shaft 1	5253-01	27, 30	59, 47	2.4	na
8	1938	Shaft 2	5154-01	30, 26	51, 41	735	[b]0.014
9	1945	Well 1	4853-02	36, 20	39, 29	818	0
10	1946	Well 2	4953-01	35, 22	43, 31	1544	0
11	1950	Well 3	4954-01	32, 21	41, 37	1126	0
12	1950	Well 4	4952-02	36, 23	45, 29	1589	0
13	1950	Well 5	4852-02	39, 23	45, 23	1570	0
14	1950	USGS T-3	5054-01	30, 23	45, 41	1067	0
15	1954	Shaft 3 BH	4953-02	35, 22	43, 31	1553	0
16	1986	Well 6	5054-02	29, 23	45, 43	1005	0
17	1987	Well 7	5055-01	27, 22	43, 47	650	0
18	1989	Well 10	4555-01	38, 12	23, 25	208	0
19	1989	Well 9	4854-01	33, 19	37, 35	808	0
20	1990	Well 8	4954-02	31, 22	43, 39	1014	0
21	1990	Well 12	4552-01	44, 16	31, 13	5	0
22	1990	Well 13	4553-01	44, 15	29, 13	0	0
23	na	Manele	4454-01	43,13	25, 15	[c]2	0
24	1950[d]	USGS T-2	4852-03	[b]39, 23	[b]45, 23	na	0

a. not available
b. based on 9/22/36 to 1/14/37 intermittent pump test (Stearns, 1940). However, ignored in calibration effort.
c. measured in 1993 when discovered by Lanai Co.
d. estimated.

It should be clear that no true "initial" ground-water-levels, even in areas with zero (0) pumpage, can be established without an initial comprehensive network of observation wells. Ground-water-levels throughout the island will fluctuate naturally under varying climactic conditions, especially in dike confined regions. However, such variations in water-levels should approach an average equilibrium over time periods where long-term natural conditions can be identified. Unfortunately, observation well networks are seldom in place prior to pumping conditions and Lanai's situation is no different. Since pumpage would affect initial regional equilibrium ground-water-levels, then the earliest drilled wells deserve greater weight in matching than wells drilled later in time. Additionally, although tunnels do not give an accurate measure of the ground-water table other than the fact that they lie below it (or above it if dry!), they do provide limits which must be met. Also, geothermal heating for Wells 1, 9, and 10 affects the water-levels initially encountered. Such heating could account for water-level differences in the neighborhood of five (5) feet for these three wells (this can easily be calculated by taking specific the ratio of water's approximate specific weight at 60° F and 100° F, or 62.37/62.00 (Roberson, & others, 1980), multiplied by a 1'x 1'x 900' water column = 5.4 ft). Therefore, the initial ground-water-levels should not be affected by geothermal activity significantly in areas with water-levels exceeding several hundred feet in elevation on Lana'i.

In addition to the steady-state calibration targets, levels or associated error targets must be defined to provide an additional basis of identifying an acceptably calibrated solution. Given the model assumptions of regional isotropy, homogeneity, and other averaged hydrologic parameters, it is unlikely that every observed water-level will match perfectly. Associated error targets provide a means of a qualifying how well the steady-state calibration targets have been achieved relative to one another. For this study, an acceptable steady-state calibration solution is achieved when the combination of all model hydraulic parameters resulting in observed tunnel flows and water-levels minimize the associated errors. This was accomplished most efficiently by defining several levels calibration and striving to maximize higher levels of matching while minimizing lower levels of matching. Therefore, such associated error targets are defined for both Maunalei Tunnel base flows and initial water-levels in which is summarized in Table 15.

Table 15. Levels of Calibration for Lana'i Numerical Model

Level of Calibration Simulated vs. Observed Water-Levels	Associated Error		
	Aquifer Type		Maunalei Tunnels Base Flow 1926-1939 (%)
	Dike-Confined (ft.)	Basal (ft.)	
1	30	1	5
2	60	2	10
3	90	3	15
4	> 90	> 3	20

Admittedly, levels of associated error targets are subjective but are based on relevant criteria. Typical flow meters and totalizers, especially older, are commonly known vary as much as 5%. Given the uncertainty of the tunnel base flow data and the completeness of their record variability is arbitrarily set in increments of 5%. For water-levels, properly installed airline measurements are accurate to the nearest 0.1 ft. Also, and as mentioned earlier, nodal interpolation errors alone may cause errors up 10 ft. in a regional model (Anderson, & others 1992) and well locations are not exactly coincident with nodal locations in the grid. The ignorance of return irrigation could also affect water-levels but such effects are probably limited to the Palawai basin area. Also, dike-confined water-levels are generally more sensitive to climactic variations than basal aquifers. Since the majority of wells on Lana'i are located in dike-confined regions their initial water-levels will be difficult to match due to local climactic differences when initially drilled. As described earlier, geothermal presence can also affect water-levels by a few feet in the Palawai Caldera. Considering these factors alone would justify an associated error of several tens of feet. Basal wells, on the other hand, typically do not exhibit the same level of sensitivity to climactic and pumping stresses. Therefore, the associated error for basal wells should be much lower than that for dike-confined water-levels; on the order of a few feet. Again, these associated errors are subjective and based on discussions with hydrologists of the USGS, CWRM, and LCo.

There are two (2) additional calibration targets which must be met before any of the initial water-level or tunnel base flow results are compared to the calibration targets identified in Table 14, pg. 77 and Table 15, pg. 78. These are the water-level closure criteria, where the numerical iteration processes will stop, and the corresponding mass balance for each run. A rule of thumb is that simulated water-level closure criteria should be one to two orders of magnitude smaller than the level of accuracy possible (Anderson, & others, 1992). Since water-levels have been measured to the nearest 0.1 ft. on Lana'i this would correspond to a closure criteria of 0.001 ft. Each calibration run had to meet this error criterion, which means that before its results were accepted, water-level changes between progressive iterative solutions for each cell could not exceed this amount. The mass balance error is calculated by MODFLOW at the end of a calibration run when the water-level closure criteria is met. A mass balance target error of 1%, or less, is considered acceptable (Anderson, & others, 1992). When both these error criterions were met the results of a calibration run were considered acceptable to rate against Tables 14 & 15.

A second major effort in this calibration process was to match transient water-levels in each well with historical data. The target transient ground-water-levels are defined as those observed in each well over the eight periods identified in Figure 31, pg. 65. The effort here is to calibrate the model's effective storage coefficient, S (see equation eq.(3), pg. 16), and also to give a sense of reliability to the initial steady-state calibration effort. As stated previously, the reasonable range of S is 0.1 to 0.3 for the unconfined aquifers. Other modelling studies in the State, on the island of Oahu, have shown that storage coefficients between 0.02 to 0.05 appear reasonable for unconfined basal situations (Eyre, & others, 1986). Whether or not this is the case for high-level unconfined aquifers is subject to conjecture. In any case, it is much more difficult to identify a S calibration or an associated error target with water-levels since they vary with time. Instead, transient water-levels were analyzed in a more spatial context at each well site. This spatial analysis also provided insight for changing boundary conditions. For example, it was found during early rounds of the transient simulations that the windward water-levels were too low while the leeward side water-levels were too high. This led to a change in the configuration of dike boundaries on the windward side which led to a better match in transient water-level response.

Model Calibration Results

Trial-and-error is the method used to arrive at best fit solutions for initial steady-state and transient recharge and pumping water-levels. In both situations, the goal is to meet the associated error and closure criteria conditions which minimize the average difference between the simulated and observed initial heads and pumping drawdowns. MODFLOW does have an automated calibration module called MODFLOWP. However, MODFLOWP is a recent code which has not been used much and it may be 10 to 20 years before the use of such automatic calibration models become standard practice (Anderson, & others, 1992). Therefore, this study remained with the trial-and-error method of calibration. It is important to understand that the trial-and-error approach does not guarantee the statistically best solution (Anderson, & others, 1992). Therefore, sensitivity analysis will be necessary later to help quantify the effects of uncertainty in the parameter estimation through this trial-and-error approach.

There are many ways to identify and measure the success of the calibration effort for Lana'i. The two (2) major categories to evaluate the calibration effort are *quantitative* and *qualitative* measures of success. The ultimate calibration objective is to minimize both types of measures of error. The statistical measures used in this study to *quantify* average differences between the simulated and observed initial heads and transient drawdowns are the mean error (**ME**), the mean absolute error (**MAE**), and the root mean squared error (**RMS**), or standard deviation. However, these *quantitative* statistical properties do not identify the spatial, or *qualitative*, distribution of the errors. Therefore, spatial relationships between simulated and observed water-levels must be evaluated as well.

Initial Steady-State Ground-Water-Levels

Over a thousand (1000) ground-water-level simulation runs were performed to calibrate the model to the initial steady-state water-level conditions. In the effort to verify the final conceptual model, many of these runs were made to test possible conceptual models which were much simpler but probably too simple to meet observed conditions. For example, through many computer runs it was found impossible to match observed water-levels with a single uniform effective global permeability, K_h, devoid of other internal boundaries to horizontal-flow, with a calibration level of 1 (see Table 15, pg. 78) for more than 1 well at any time. Likewise, it was found impossible to match observed water-levels by using only field identified dike and fault and boundaries alone without any inference of unseen barriers to horizontal-flow which must exist in the known rift zones. Thus, the failure of these simpler conceptual models mean that they are too simple and that there must be many unseen internal boundaries. Some adjustments to internal boundary conditions were necessary in the rift zones and along the shoreline to calibrate the model but overall there is little deviation from the initial assumptions of homogeneity, isotropy, and simplicity for the regional scale of the Lana'i numerical model. Therefore, many of the earlier simulations ruled out other possible conceptual models.

Following the initial invalidation of oversimplified conceptual models, the final conceptual model, as shown in Figure 33, pg. 72, was calibrated by varying the various hydraulic parameters until a best fit match for the in initial steady-state water-levels was obtained. MODFLOW input data and resulting output data for the best fit calibration are in Appendix C and D.

Summaries of calibrated initial steady-state ground-water-levels conditions are shown in Tables 16 & 17 and Figures 33 and 35. It is important to understand that this is not a unique solution and that other values of these hydraulic parameters can result in similar results although changes in internal boundary conditions have a much greater effect on the resulting water-level distribution. For example, it was found that under the original boundaries to horizontal-flow configuration initial water-levels for Wells 1 and 12 were several hundred feet too high when other wells seemed to be reasonably matched. The solution for this was to remove a single makai most boundary to horizontal-flow rather than altering the hydraulic permeabilities locally. Likewise, using recharge distributions from past studies resulted in Shaft 2, the most important initial water-level, drying up consistently when pumped at its long-term average, which is not consistent with reality. Only after using the GIS recharge determined for this study was the Shaft 2 problem resolved. An important feature of the steady-state calibration effort was that the Upper Maunalei Tunnel needed to cross into the next mauka cell since a single cell did not provide enough flow. This is reasonable since the tunnel source is really horizontal and may indeed cross into another cell in the conceptual model. Whether or not this is true, such a change is necessary for the model to achieve the defined steady-state target conditions.

Table 16. Resultant Calibration Parameters for Initial Steady-State Conditions

Parameter	Property	Value	unit
S	Storage Coefficient	0	dimensionless
K_h (both x & y directions) Island Palawai Caldera	Global Horizontal Permeability	 1000 100	 ft/day ft/day
SC Southern coast Northern coast	Coastal Leakance	 4×10^8 4×10^4	 ft^2/day ft^2/day
$HYDCHR_u$ Dike Complexl	Horizontal Flow Boundary Conductance	 5.01×10^{-5}	 1/day
DC Lower Maunalei Upper Maunalei Extension of upper	Drain Leakance	 255.84 1370.00 1370.00	 ft^2/day ft^2/day ft^2/day
R	Recharge	61.60	mgd
Area of *R*	Recharge area	140.83	mi^2
Bottom Elevation	Bottom of model	-400	ft
Pumping	Pumpage scenario	0	mgd
MODFLOW Calculations	**Accepted Calibration Targets**	**Value**	**unit**
Mass Balance	values < 1.0% are acceptable	-0.05	%
Closure Criteria	water-level changes < 0.001 ft stops iteration	na	ft.

Table 17. Best Fit Steady-State Calibration Results

Rank	Well Name	Initial Water-Level (ft. msl)	Calibrated 1939 Water-Level (ft. msl)	$^{a}H_{ob}$ / H_{sim}	Δ	Level of Calibration	Discharge Q (mgd)
1	Gay Well A	2	2.5	0.80	+0.5	1	0
*2	Lower Tunnel	1103	1240	0.89	+137	[b]1	0.261
*3	Upper Tunnel	1500	1506	0.99	+6	[a]1	0.064
*4	MH Tunnel	(dry)<2700	1841	[c]nn	nn	1	0
*5	Gay Tunnel	(dry)<1920	1504	nn	nn	1	0
*6	Waiapaa Tunnel	(dry)<2220	1743	nn	nn	1	0
7	Shaft 1	2.4	2.4	1.00	0	1	0
8	Shaft 2	735	738	1.00	+3	1	0
9	Well 1	818	850	0.96	+32	2	0
10	Well 2	1544	1523	1.01	-21	1	0
11	Well 3	1126	1154	0.98	-28	1	0
12	Well 4	1589	1625	0.98	+36	2	0
13	Well 5	1570	1723	0.91	+153	4	0
14	USGS T-3	1067	1131	0.94	+64	3	0
15	Shaft 3 BH	1553	1523	1.02	-14	1	0
16	Well 6	1005	991	1.01	-14	1	0
17	Well 7	650	755	0.86	+105	4	0
18	Well 10	208	318	0.65	+110	4	0
19	Well 9	808	846	0.96	+38	2	0
20	Well 8	1014	1191	0.85	+177	4	0
21	Well 12	5	0.3	16.67	-4.7	4	0
22	Well 13	0	0.7	0.00	+0.7	1	0
23	Manele	[d]2	2.3	0.87	+0.3	1	0
*24	USGS T-2	[e]na	na	na	na	na	0

a. observed water-level, H_{ob}, divided by simulated calibration water-level, H_{sim}
b. related to steady-stale flow equal to '26-'39 average.
c. not necessary
d. measured in 1993 when discovered by Lanai Co.
e. not available.

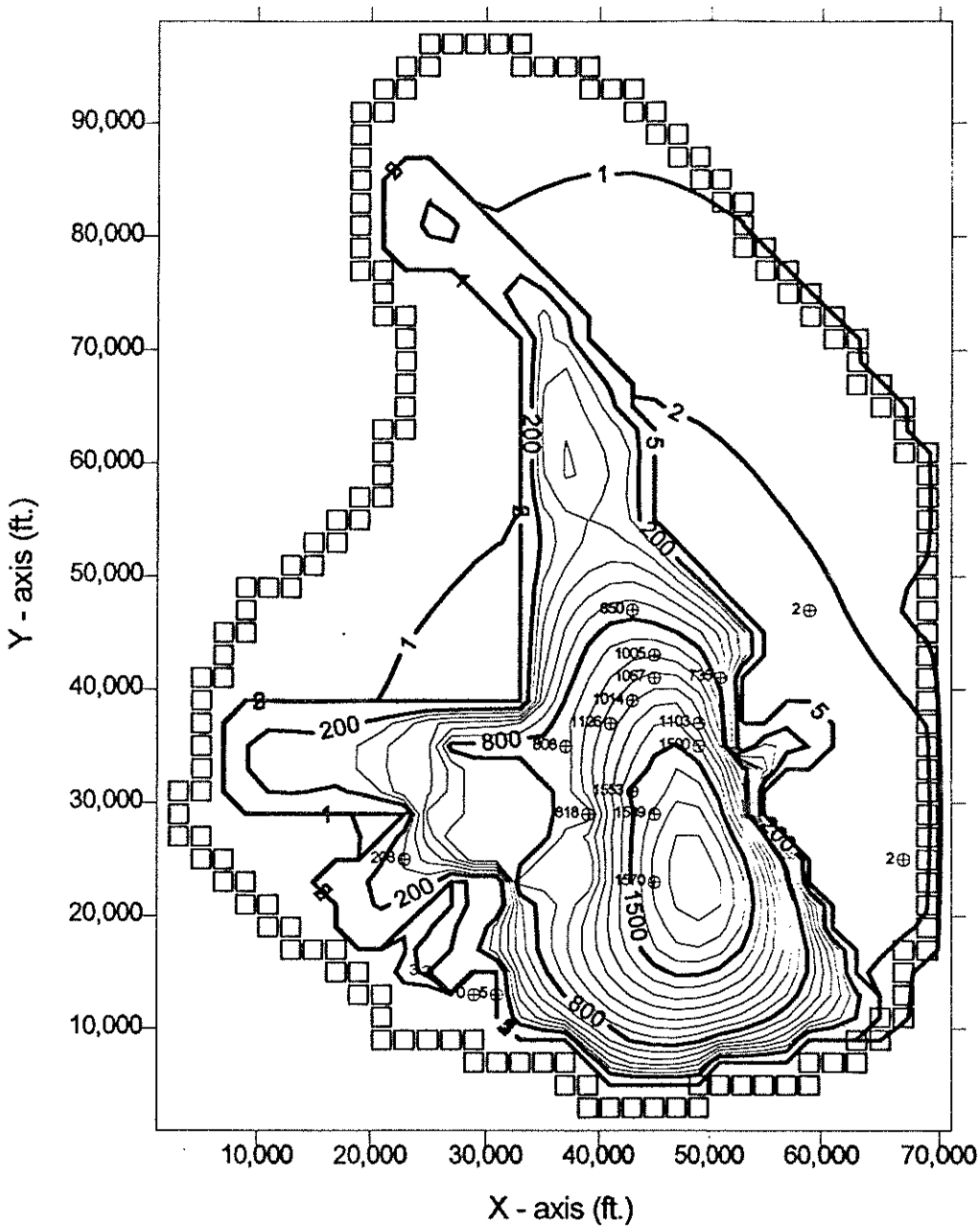
$$ME = \frac{1}{n}\Sigma(initial - calibrated) = -40.4$$ where $n = 18$ (wells marked * not counted)

$$MAE = \frac{1}{n}\Sigma(|initial - calibrated|) = 48.1$$

$$RMS = \left[\frac{1}{n}\Sigma(initial - calibrated)^2\right]^{0.5} = 72.3$$

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Best-Fit Calibration with Fog-Drip



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
and where river bottom = -10 msl.
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 0 mgd
Flow from Lower Maunalei Tunnel = 0.261 mgd
Flow from Upper Maunalei Tunnel = 0.064 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1868 ft. above mean sea level.
(contour truncated at 1800 ft. above msl)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

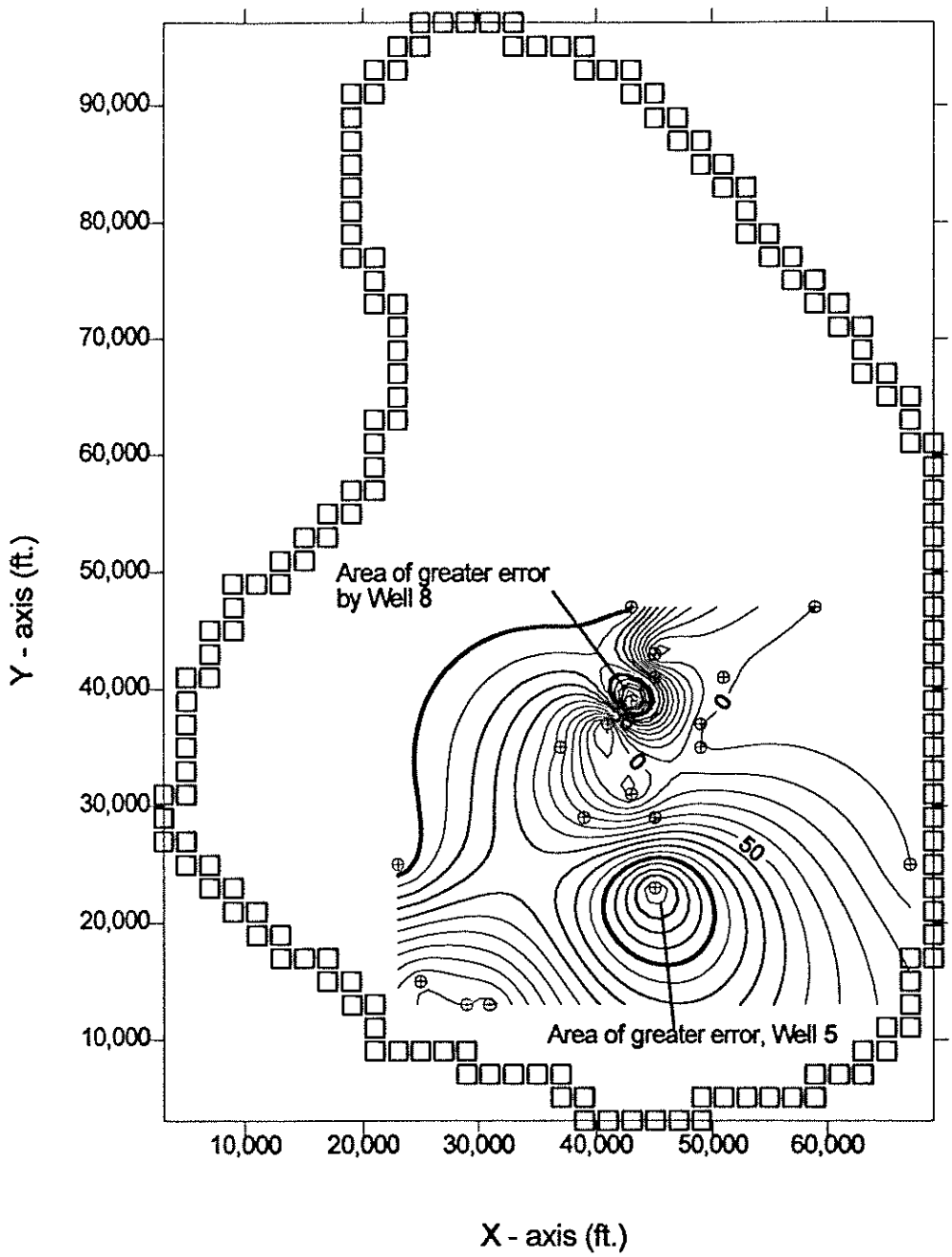
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 34. Spatial Contour Results of Best Fit Calibration (also see Figure 33, pg. 72)

Simulated Regional Steady-State Drawdown Contours for Lanai

Best-Fit Calibration Spatial Error Distribution



MODFLOW OUPUT THROUGH SURFER GRAPHICS

Minimum error = -20 ft.
Maximum error = 160 ft.
Contour interval = 10 ft., Darkest contour line is +100 ft

⊕ - Well locations with original water levels.

□ - Numerical Coastline of Lanai

Figure 35. Spatial Distribution of Errors for Best Fit Calibration

From Table 17, pg. 82, the MAE of the simulated water-levels for all wells is 48 ft., which implies that the overall match is fair (Level 2, as defined in Table 15, pg. 78) while the standard deviation is 72 ft. (Level 3). However, considering the assumptions of homogeneity and isotropy and the transient considerations of wells coming on-line at various times, the match is better than expected. Additionally, calibrated hydraulic parameters from Table 16, pg. 81, fall within the range of reasonable values mentioned earlier in this report.

To investigate the reasonableness of the 61.60 mgd recharge ***R*** input, a separate calibration was performed where the fog-drip component of ***R*** was entirely removed. The total average ***R*** for this situation was 53.18 mgd (see Table 12, pg. 48). The model was then calibrated using the same technique and closure criteria from the previous calibration effort. The best calibration fit parameter values with the no fog-drip ***R*** are summarized in Table 18 below.

Table 18. Resultant Calibration Parameters for No-Fog Steady-State Conditions

Parameter	Property	Value	unit
S	Storage Coefficient	0	dimensionless
K_h (both x & y directions) Island Palawai Caldera	Global Horizontal Permeability	 1000 100	 ft/day ft/day
SC Southern coast Northern coast	Coastal Leakance	 4×10^8 4×10^4	 ft^2/day ft^2/day
$HYDCHR_u$ Dike Complex	Horizontal Flow Boundary Conductance	 2.40×10^{-5}	 1/day
DC Lower Maunalei Upper Maunalei Extension of upper	Drain Leakance	 5120.00 5120.00 5120.00	 ft^2/day ft^2/day ft^2/day
R	Recharge	53.18	mgd
Area of *R*	Recharge area	140.83	mi^2
Bottom Elevation	Bottom of model	-400	ft
Pumping	Pumpage scenario	0	mgd
MODFLOW Calculations	**Accepted Calibration Targets**	**Value**	**unit**
Mass Balance	values < 1.0% are acceptable	-0.05	%
Closure Criteria	water-level changes < 0.001 ft stops iteration	na	ft.

As expected, the $HYDCHR_u$ and *DC* terms were different in the no fog-drip ***R*** scenario. The best way to compare the impacts of these changes is to view the changes in the profile of the resulting changes in water-levels (see Figures 36 & 37 on the following pages). For statistical information, the standard deviation of simulated water-levels under the no-fog calibration was 258 ft. which is three times greater (worse) than the standard deviation calibration with fog.

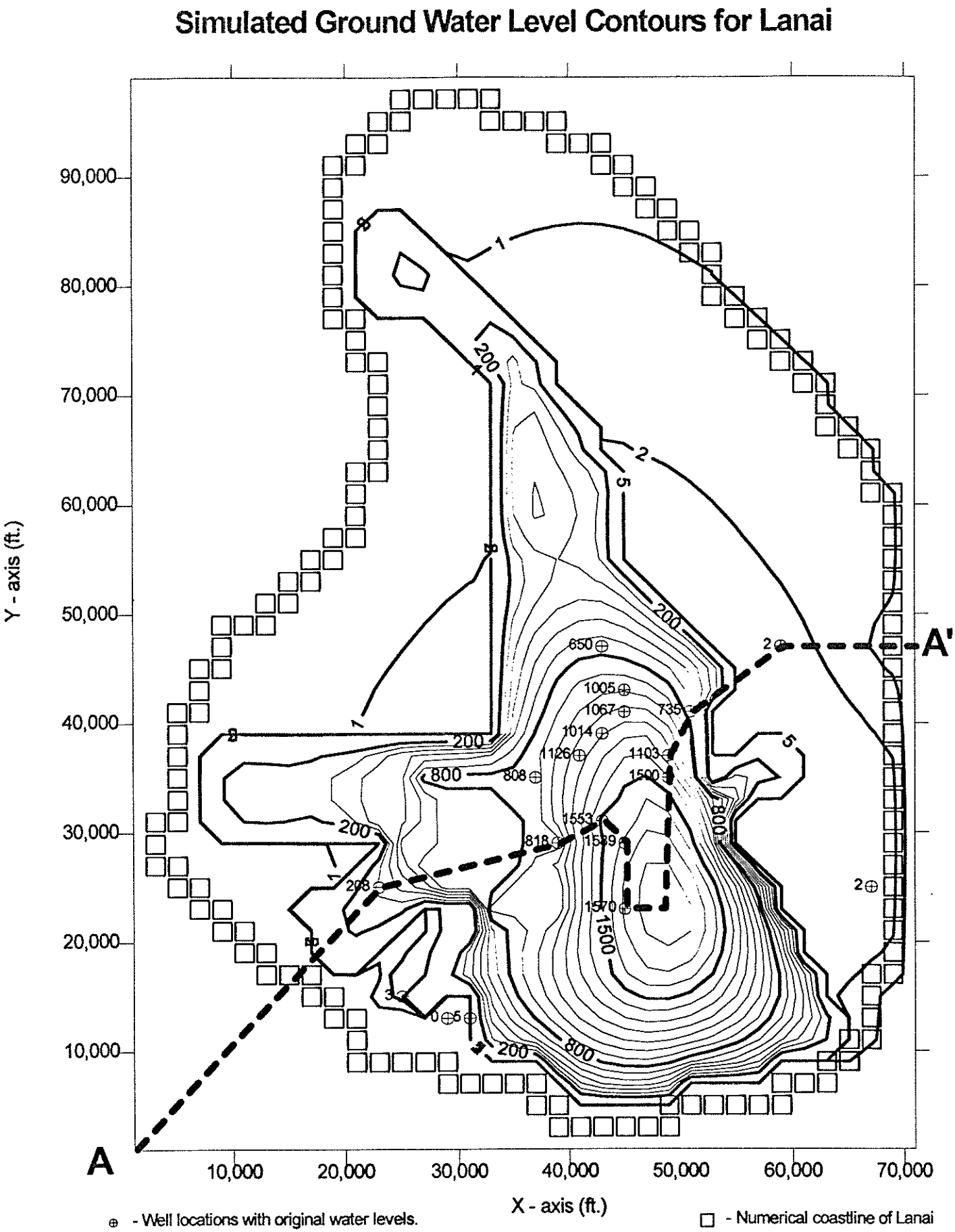


Figure 36. **Profile Line A-A' Superimposed on typical Ground-Water-Level Contours Output**

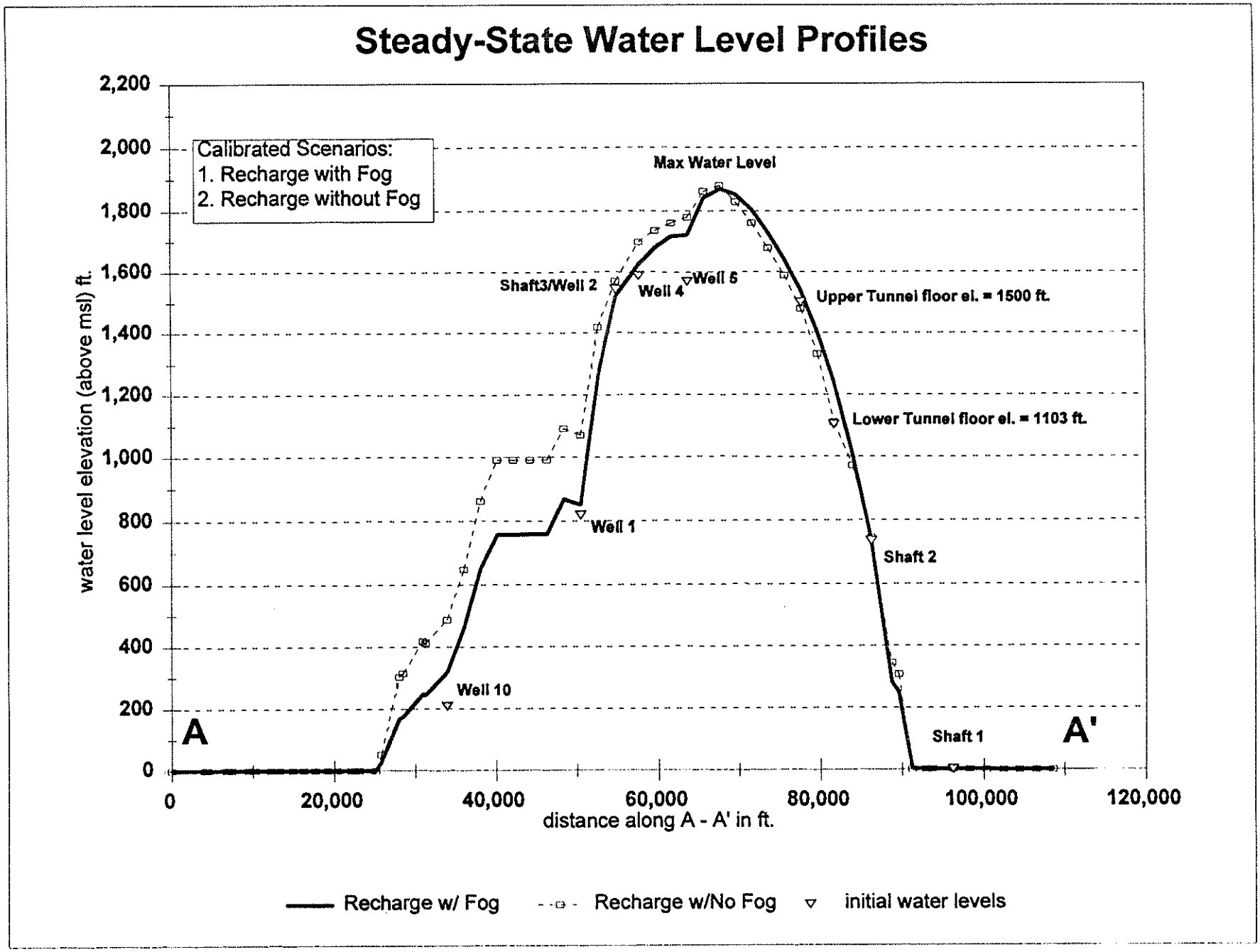


Figure 37. **Resulting Profile A-A'** (see Figure 36, pg. 86) **Differences from Fog vs. No Fog Recharge Calibration.**

The results of this alternative calibration show that, for the given conceptual model with all its assumptions and identical internal boundary locations, the ***R*** with ***FD*** is a better estimate of island ***R*** than without ***FD***, for several reasons. First, it was impossible to get the Upper Maunalei Tunnel to flow at all under the same steady-state model conditions as the previous calibration. It was found that additional 2000 ft. mauka extensions to *both* tunnels was necessary to achieve the calibration target of historic tunnel flows observed, before any other wells were drilled, for ***R*** without ***FD***. These boundary changes are not incorporated into Figure 37, pg. 87 since we are comparing calibrations without boundary changes which is a more meaningful comparison. Therefore, it was only possible to match the Lower Maunalei Tunnel flow and initial Shaft 2 water-levels but not the Upper Maunalei Tunnel flow. This is clearly visible in Figure 37, pg. 87 since the Upper Maunalei Tunnel will not flow in the ***R*** without ***FD*** scenario since the bottom of the tunnel floor lies above the ground-water-level. Even if these boundary changes were allowed the horizontal flow boundary, $\boldsymbol{HYDCHR_u}$ had to be decreased such that ground-water-levels could rise to achieve not only tunnel flow but the observed initial water-level at Shaft 2.

The fact that $\boldsymbol{HYDCHR_u}$ must be decreased (tightened) to meet the calibration targets is expected, since less recharge would require tighter dike and fault formations to increase water-levels to compensate for less ***R***, and is the second reason why ***R*** with ***FD*** is a better estimate of island ***R*** than without ***FD***. Removing ***FD*** from ***R*** affects water-levels on the leeward side more than the windward side of the island. For ***R*** without ***FD,*** calibrated water-levels on the leeward side of the island are consistently higher than if ***R*** incorporates ***FD***, as is clearly shown in Figure 37, pg. 87. All the observed initial high-level water-levels with a calibration level greater than 1 are already lower than water-levels from the calibration with ***R*** containing ***FD*** (see Table 15, pg. 78 and Table 17, pg. 82). Therefore, removing ***FD*** from ***R*** increases this error rather than decreasing it.

Lastly, the decrease in $\boldsymbol{HYDCHR_u}$ will also affect aquifer response to long-term average pumpage such that drawdowns for the model calibrated without ***FD*** are less reasonable. Figure 38, pg. 89 shows that even with long-term pumping the water-levels at Wells 1 and 10 are on the order of 200 to 300 ft higher than what has been initially observed at these two wells sites. Also, drawdowns in other wells seem much more drastic than what is observed in the field. From Figure 38, pg. 89 it can be seen that the drawdowns at Wells 2 & 4 should be on the order of 300 to 600 ft greater than what is currently observed and historical behavior of these sources do not indicate that such drawdowns would be expected. The only exception of ground-water-level response without ***FD*** is Well 5, which appears to be a better match than the calibration with ***FD***. However, Well 5 is known to have efficiency problems and, as will be seen later in transient runs, this source is one of the more poorly modeled wells in this report. Therefore, it is the opinion of the author that this figure is further evidence that the model calibrated with ***FD*** is a better calibration than without it. Therefore, calibration parameters made with ***FD***, as described in Table 16, pg. 81 are deemed the "best-fit" calibration model from here on in this report.

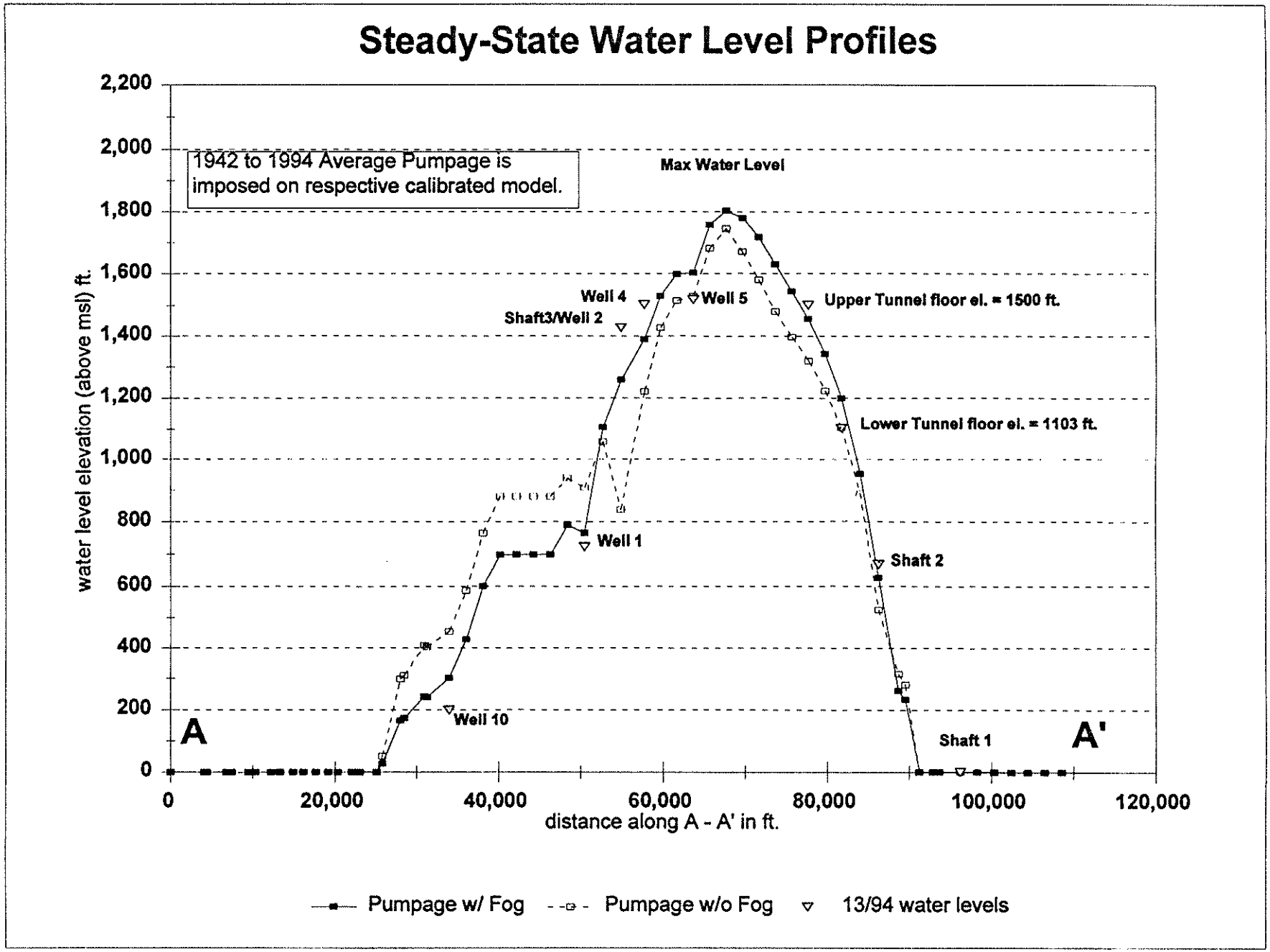


Figure 38. Resulting Profile A-A' Differences In Long-Term Pumpage Results on *FD* vs. *NO-FD* Calibrations

Transient Recharge, Pumping, and Water-Levels

Following the steady-state initial water-level calibration, transient water-levels are investigated to calibrate the effective storage coefficient ***S*** and to further provide confidence in the calibration of the steady-state conditions. As shown from Figure 31, pg. 65, there are eight (8) periods of significant changes in static water-level trends from 1942 to 1994. These periods correspond to what are called stress periods in the numerical model. Therefore, there are eight (8) stress periods in the transient model input. Since the high-level water elevations are sensitive to both climactic and pumping stresses both must be defined for and varied within each stress period.

Varying recharge, ***R*** (with fog-drip, ***FD***), over the specified periods was accomplished through the GIS by applying the fractional monthly departure from the long-term monthly means for rainfall, ***RF***, and running the recharge model with these modified ***RF*** variables for each period. No other water-budget parameters were altered and it is assumed that the lag-time between recharge and water-levels is negligible. The results for the periodic ***RF*** departure computations are shown in Table 19, pg. 91. The resulting effect on the GIS ***R*** departure computations for each stress period are shown in Table 20, pg. 91, and it is interesting to note that they generally exceed ***RF*** departures. The reason for the difference in departures is most likely due to the differences in ET_m which is dependent on changes in soil-moisture storage, ΔSMS_m, which was discussed earlier in this report. Computations of periodic recharge rates used in deriving the tables 19& 20 can be found in Appendix E.

Of the twenty-four (24) ground-water sources identified for Lana'i in this report, only eleven (11) of these were pumped significantly and of these eleven only nine (9) have water-level responses to pumpage and climactic changes. These production wells and their corresponding average pumpage for each period are summarized in Table 21, pg. 92. Yearly time-steps were investigated for each stress period. For example, in stress period one, '42 to '51, there are ten (10) years or ten (10) time-steps in the model. In each of these time-steps the model will iterate to a solution which meets the criteria set forth in Table 16, pg. 81 before moving to the next time-step. However, since this is a transient simulation the water balance criteria does not have to necessarily meet the steady-state condition of 0.05% difference since changes in storage now occur.

For comparison, specific capacities reported by Takasaki & Mink (1982) for wells in the Waiahole-Waikane dike complex region range between 1 to 10 gal/min/ft which means that a well pumped at a rate of 200 gal/min would result in a drawdown of between 200 to 20 ft., respectively. This is consistent with the current reaction of most individual wells pumpage on Lana'i.

With the transient input variations established, calibration of the storage coefficient, ***S***, was approached by trial-and-error. Five (5) ***S*** values were investigated; 0.01, 0.05, 0.1, 0.2, 0.4 with the assumption of homogeneity on the island-wide regional scale. No lag-times were considered. The resulting transient water-level runs and tunnel flows for the final calibration are found in Appendix F. The best ***S*** value is the one which matches the trend or relative changes in ground-water-levels for each source. This is best accomplished by matching the departures from the mean for each source for the observed data and each resulting simulated transient run. These results are graphed in Appendix F.

Table 19. Stress Period Departures from Mean *RF* for *R* Calculations

Month	Departure from Monthly Mean Rainfall, *RF*, in %							
	Period 1 '42-'51	Period 2 '52-'56	Period 3 '57-'8/611	Period 4 '9/61-'64	Period 5 '65-'69	Period 6 '70-'83	Period 7 '84-'90	Period 8 '91-'94
Jan.	14.77	-13.10	3.13	77.44	29.92	27.36	-37.71	-43.66
Feb.	-6.23	-13.59	-44.13	-67.36	22.25	9.65	16.79	-11.74
Mar.	29.45	-24.45	-12.96	95.58	17.22	-28.30	-27.09	-44.72
Apr.	51.41	-53.29	-53.56	48.40	67.50	-4.66	21.17	-82.77
May	-13.47	-39.58	42.09	97.79	70.22	-22.72	-5.76	-11.06
Jun.	30.95	-37.45	-18.38	-25.96	-11.88	8.19	-1.25	24.42
Jul.	21.07	11.60	-32.84	67.62	65.03	-17.85	10.92	2.60
Aug.	5.05	-19.56	-8.62	-1.57	13.13	2.21	-39.67	-13.87
Sep.	-19.58	-11.01	-11.77	-49.95	96.22	-34.25	-6.50	48.99
Oct.	-38.50	-27.36	-30.10	43.63	6.83	-23.09	10.06	15.51
Nov.	-11.90	31.00	-5.43	15.68	96.02	-19.52	23.71	-21.95
Dec.	-10.99	39.12	-14.88	-20.92	38.12	2.61	28.30	-35.42
Year	3.66	-10.84	-14.99	27.62	42.68	-6.29	-0.89	-21.13

Table 20. Stress Period Departures from Mean *R* from GIS Model

Month	Departure from Monthly Mean Recharge, *R*, in %							
	Period 1 '42-'51	Period 2 '52-'56	Period 3 '57-'8/61	Period 4 '9/61-/64	Period 5 '65-'69	Period 6 '70-'83	Period 7 '84-'90	Period 8 '91-'94
Jan.	20.46	-17.90	4.28	112.92	42.34	38.65	-50.71	-58.21
Feb.	-9.23	-19.95	-57.88	-74.44	35.10	14.47	25.98	-17.25
Mar.	52.34	-40.90	-22.40	178.84	30.20	-46.39	-44.67	-69.27
Apr.	100.92	-76.76	-77.04	94.66	135.11	-8.18	39.93	-91.73
May	-27.12	-60.09	105.47	280.84	191.78	-41.50	-12.35	-24.11
Jun.	51.13	-40.38	35.09	-29.06	-15.09	13.40	-2.08	39.81
Jul.	29.69	14.53	-36.48	130.86	124.92	-21.00	14.74	4.14
Aug.	7.81	-25.52	-12.85	-2.43	20.14	3.47	-44.44	-18.92
Sep.	-32.73	-19.04	-20.30	-67.92	269.25	-49.01	-11.65	112.55
Oct.	-64.72	-51.25	-54.60	100.38	16.27	-46.16	21.00	34.75
Nov.	-19.19	53.83	-9.33	26.68	179.62	-31.24	40.79	-34.38
Dec.	-15.08	54.91	-20.26	-27.75	54.20	3.20	39.41	-44.62
Year	10.91	-9.71	-20.41	63.41	73.452	-2.71	-0.85	-41.06

Table 21. Stress Period Pumpage Input

Well	Average Pumpage mgd[a]							
	Period 1 '42-'52	Period 2 '52-'56	Period 3 '57-'8/61	Period 4 '9/61-'64	Period 5 '65-'69	Period 6 '70-'83	Period 7 '84-'90	Period 8 '91-'94
[b]Upper Tunnel	0.223	0.103	0.040	0.027	0.042	0.026	0.051	0
[b]Lower Tunnel	0.206	0.112	0.115	0.138	0.198	0.094	0.107	0.072
Shaft 2	0.216	0.140	0.157	0.109	0.058	0.060	0.435	0.513
Shaft 3 BH	0	0	0.596	0.378	0.291	0.409	0.310	0
Well 1	0.029	0.038	0.095	0.073	0.002	0.119	0.286	0.110
Well 2	0.171	0.360	1.000	0.287	0.360	0.374	0.355	0.193
Well 3	0.005	0.196	0.194	0.125	0.058	0.319	0.345	0.285
Well 4	0.003	0.105	0.219	0.160	0.023	0.315	0.766	0.506
Well 5	0.016	0.232	0.099	0.066	0.077	0.234	0.288	0.105
Well 6	0	0	0	0	0	0	0.019	0.330
Well 9	0	0	0	0	0	0	0	0.145
Total	0.868	1.287	2.516	1.364	1.110	1.949	2.961	2.260
Well	Average Pumpage cfd[c] (for MODFLOW input)							
[b]Upper Tunnel	29808.2	13775.2	5300.6	3605.6	5581.9	2420.3	6850.1	0
[b]Lower Tunnel	27520.9	15015.9	15355.8	18411.2	26490.8	12573.6	14238.1	7617.2
Shaft 2	28880.0	18701.5	21029.9	14583.7	7742.2	8063.5	58159.0	68582.6
Shaft 3 BH	0	0	79698.8	50545.4	38849.3	54657.8	51392.2	0
Well 1	3874.6	5087.2	12737.3	9812.9	315.7	15842.0	39261.1	14770.1
Well 2	222856.5	48125.5	133743.4	38413.4	48189.4	49993.1	47487.9	25827.2
Well 3	623.3	26223.3	25973.4	16742.8	7784.5	42678.7	46053.6	38084.1
Well 4	340.0	14062.8	29297.0	21412.2	3128.8	42078.8	102414.9	67705.1
Well 5	2174.4	31078.2	13239.3	8858.4	10254.2	31291.9	38439.5	14026.3
Well 6	0	0	0	0	0	0	2519.4	44103.6
Well 9	0	0	0	0	0	0	0	19423.7
Total	1.16×10^5	1.72×10^5	3.36×10^5	1.82×10^5	1.48×10^5	2.61×10^5	3.96×10^5	3.02×10^5

a. million gallons per day
b. Gravity flow
c. cubic feet per day

Several important observations resulted from the transient analysis. First, in earlier transient simulations it was found that the transient windward water-levels were to low and the leeward were too high. This prompted a change in the internal boundary conditions by adding several additional horizontal flow boundaries in the Puu Kawelo and Puu Mahana area. Additionally, a mauka horizontal flow boundary in the Shaft 3 bulkhead was removed since the tunnel here does extend for some distance. These changes, in turn, necessitated a recalibration effort to meet the initial steady-state conditions which was then followed again by transient analysis. This circular type of calibration effort resulted in a much better match for all observed water-levels. Secondly, there is no one best *S* value which can accommodate the entire island on the regional scale. This should cast some doubt on the validity of the initial assumptions of homogeneity and isotropy on the regional scale. From the various figures in Appendix F it can be seen that some simulated transient water-levels match observed trends better than others for different *S* values. Table 22 was constructed to show these differences in matching trends.

Table 22. Best Match for Transient Conditions

Source	Storage Coefficient, *S*				
	0.01	0.05	0.1	0.2	0.4
[a]Upper Tunnel	best				
[a]Lower Tunnel	best				
Shaft 1					best
Shaft 2					best
[b]Shaft 3 BH				best	
Well 1	best				
Well 2					best
Well 3		best			
Well 4				best	
Well 5			best		
[c]Well 6					
[c]Well 9					
Total	3	1	1	2	3

a. Gravity flow
b. Pumped in model but actually gravity flow tunnel
c. Not enough information to assess.

An additional transient run was made to investigate and provide a estimate of how close the present situation is to steady-state conditions. The long-term average pumpage for each source was induced on the best-fit calibrated model and run for 1000 years into the future. A single *S* value 0.1 was chosen for this exercise. Results for each well in this exercise is found in Appendix G. According to this exercise, water-levels in wells are between 10%-90% of steady-state water-levels for the long-term pumpage between 1942 to 1994 excluding well 5.

Model Sensitivity Analysis

As noted earlier, the trial-and-error approach of parameter estimation does not guarantee the statistically best fit, and sensitivity analysis is necessary. Sensitivity analysis is simply observing the water-level response changing an individual hydraulic parameter on the best fit calibration while holding all other parameters and boundary location conditions constant. This is done to help quantify the uncertainty of the calibrated Lana'i numerical model. Specifically, the individual regionally effective model parameters are; the global and caldera horizontal hydraulic conductivity, K_h, the horizontal-flow barrier (HFB) hydraulic characteristic, $HYDCHR_u$, the north and south coastal streambed conductance term, SC, the tunnel drain conductance term DC, and the input flux of recharge, R. Each parameter was varied individually by increasing or decreasing its calibrated value over the range of $\pm$ 100% and the model run to steady-state. The changes in resulting ground-water-levels between the simulated steady-state best fit calibration and sensitivity runs is summarized in Figure 39, pg. 95.

It is important to understand that Figure 39, pg. 95 shows the sensitivity of the calibrated model based only on the internal boundary geometry, the simplified assumptions of regional homogeneity and isotropy for the hydraulic values of these boundaries, and the steady-state conditions discussed earlier. Figure 39, pg. 95, does not include the model's sensitivity to changing mathematical or internal boundary geometry nor initial seed conditions, such as starting head values for a specific computer run. Changing internal boundary conditions will create an alternative solution which could be calibrated, graphed similarly, and would also show a trend towards a zero (0) mean absolute error along the x-axis of the figure. What is also missing from Figure 39 is the models's sensitivity to changes in internal boundary conditions. Through the calibration effort it was clear that the Lana'i model is also quite sensitive to small changes in the locations of internal boundary conditions. For example, removing only a few horizontal flow boundaries had dramatic regional and local effects on water-levels. In fact, other recent studies (Meyer & Souza, 1995) have shown that water-level responses to pumping in compartmentalized high-level type aquifers are very sensitive in numeric models. Changing the calibrated boundary geometry, in effect, creates a new model.

From the sensitivity analysis it is clear that the model is most sensitive to changes in the horizontal flow boundary, $HYDCHR_u$ and recharge, R. The sensitivity to $HYDCHR_u$ and R should not be surprising since these internal boundaries are known to be a reason for high-level aquifers and their observed sensitivity to climactic conditions in the real world. Since the model is sensitive to $HYDCHR_u$ it follows that the model must then be sensitive to the locations of these internal boundaries. This supports the statement made in the preceding paragraph that the model is very sensitive to changes in boundary locations but is difficult to show in the graphical manner as done in Figure 39, pg. 95.

A few other statements can be made from the behavior of the sensitivity curves. The model seems to be equally sensitive to equal changes in both $HYDCHR_u$ and R. This indicates that the two are correlated which makes sense since the lack of either one would result in no high-level water. Changes to other parameters in the model do not induce significant changes until much larger percentage increases than $HYDCHR_u$ and R, and even then the MAE is much less.

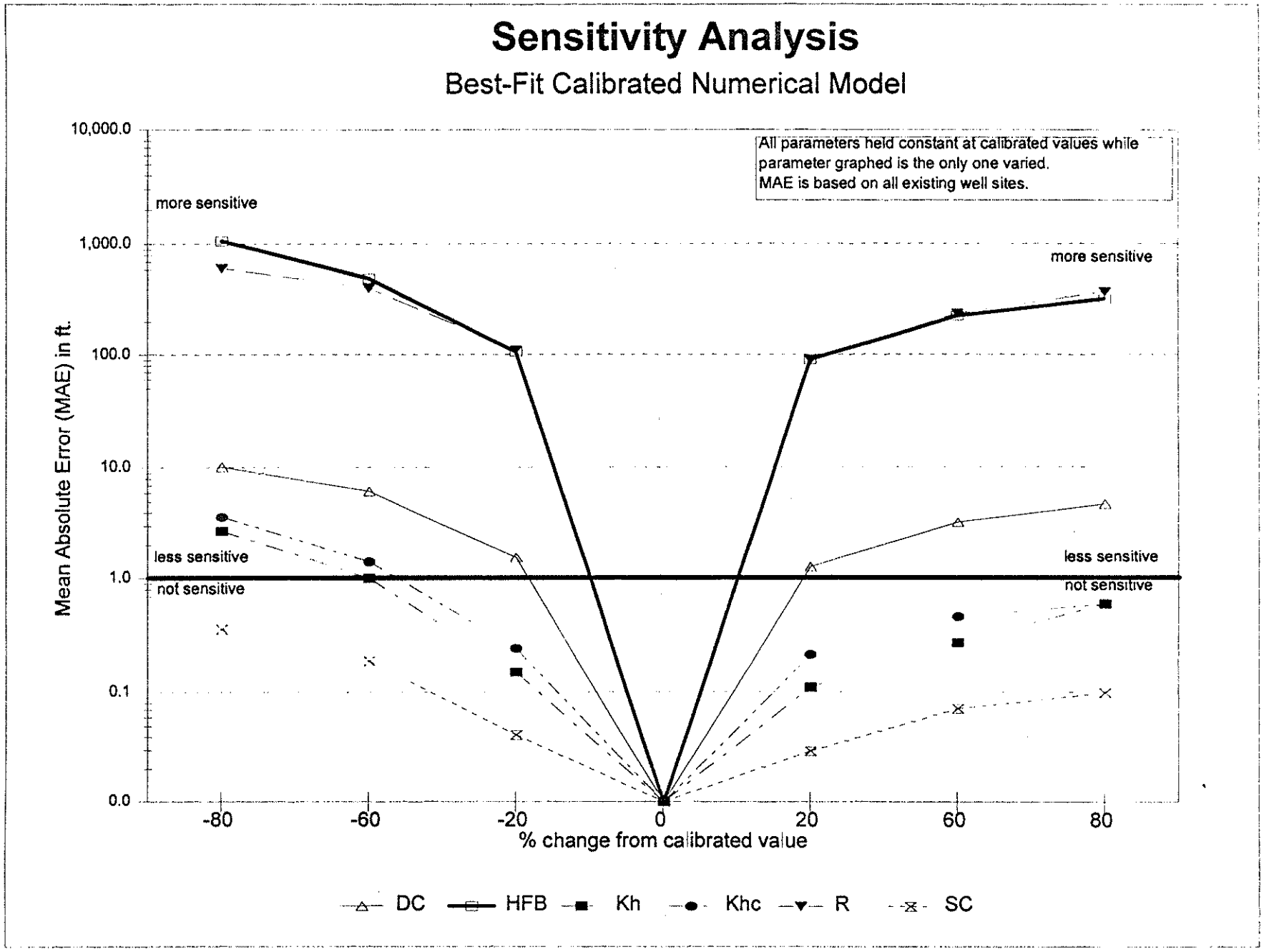


Figure 39. Sensitivity Curves of Calibrated Model

Model Predictive Runs

Using the best-fit calibrated model as the base, six (6) predictive scenarios were investigated to assess potential regional ground-water-level responses to various stresses. The first predictive run was made to assess the impacts of pumping at the long-term '42-'94 average. Secondly, fog-drip only is removed (i.e. no pumpage). Third, the model is pumped at the current CWRM estimate of island-wide sustainable yield (6 mgd) through existing wells normally operated. The fourth predictive run combines the impacts of scenarios 2 and 3; removing fog-drip and imposing 6 mgd pumpage. Fifth, the Wells 1 & 9 in the caldera were pumped alone with all other wells turned off. Lastly, a potential pumpage distribution specified by LCo. is investigated.

Pumpage was not constrained by the actual physical limitations of each well. Estimated future withdrawals from existing wells to meet the 6 mgd pumpage for scenarios 3 & 4 are simply a matter of convenience. This approach is probably not an accurate prediction of actual future operations but it serves as an objective way of distributing 6 mgd pumpage. Not knowing the future distribution of such an increase in pumpage, additional necessary pumpage was distributed evenly amongst the existing recent annual average pumpage for each high-level pumped well. Future pumpage for Scenario 5, concerning the caldera, is evenly distributed between Wells 1 & 9. Pumpage in scenario 6 was specified by LCo.'s hydrologic/engineering consultant. The pumpage values used in these predictive scenarios are summarized in Table 23.

Table 23. Individual Well Pumpage for Predictive Model Runs

	SCENARIO WELL PUMPAGES									
	1		2		3 & 4		5		6	
	'42-'94 Average		No Fog		6 mgd (CWRM SY)		Caldera Only		Lanai Co.	
Wells	mgd	cfd	mgd	cfd	mgd	cfd	mgd	cfd	mgd	cfd
Upper Tunnel	[a]ff	ff	ff	ff	ff	ff	ff	ff	ff	ff
Lower Tunnel	ff	ff	ff	ff	ff	ff	ff	ff	ff	ff
Shaft 2	0.196	26,190	0	0	1.044	139,618	0	0	0.500	66,836
Well 1	0.116	15,479	0	0	0.690	92,229	0.325	43,450	0.270	36,091
Well 2/Shaft 3	0.721	83,021	0	0	0.604	80,786	0	0	0.300	40,102
Well 3	0.205	27,398	0	0	0.683	91,291	0	0	0.300	40,102
Well 4	0.273	36,483	0	0	0.918	122,668	0	0	0.400	53,469
Well 5	0.155	20,738	0	0	0.531	71,010	0	0	0.400	53,469
Well 6	0.029	3,919	0	0	0.746	99,744	0	0	0.300	40,102
Well 7	0	0	0	0	0	0	0	0	0.200	26,734
Well 8	0	0	0	0	0	0	0	0	0.300	40,102
Well 9	0.012	1,571	0	0	0.784	104,733	0.325	43,450	0.270	36,091
[b]Well 14	0	0	0	0	0	0	0	0	0.280	37,428
[c]Total	1.607	214,800	0	0	6.000	802,079	0.650	86,900	3.520	470,526

a. ff - free-flowing, no induced pumping.
b. Future well under construction and not online.
c. Ignores any contribution of tunnel flow to total ground-water removal via artificial means.

Predictive Run Results

Before discussing predictive run results, it is an appropriate time to clarify the issue of sustainable yield and regional water-level response. The reader may recall from Table 1, pg. 3, the issue regarding the definition of the term 'safe yield' between Stearns and Anderson. The issue is significant since it highlights what other respected hydrologists (Theis, 1994 & Lohman, 1979) have identified as the "Alice-in-Wonderland" syndrome where there is a plethora of definitions for aquifers and safe yields which complicate the communication and representation of these hydrologic concepts. Likewise, the definition of sustainable yield has many different meanings to many different people both familiar and unfamiliar to ground-water hydrology. Therefore, it is important to understand that the results from the six (6) predictive runs **do not** define a single sole "number" for the sustainable yield for Lana'i. Instead, the numerical model will only attempt to predict Lanai's *regional* or *aquifer* ground-water-level response to particular stress scenarios.

Another important issue must be clarified before interpreting predictive results. It is important to understand that *regional* or *aquifer* responses predicted by the model **do not** predict *localized* or *discrete* water-levels over areas smaller than a single cell grid. In other words, water-levels predicted by the model represent the *average* water-level found within an entire cell grid which covers a 2000' by 2000' area. For *local* or *site* changes in ground-water-levels (more discrete locations within grid cells, such as pumping wells), it can only be said that such changes are only as accurate as the *regional* water-level prediction for the particular grid cell in which they reside. The numerical model is predicting the average regional water-level at each cell node which represents a 2000 ft. by 2000 ft. area and not a typical 12 to 18-inch diameter well. One would have to increase the discretization of the model grid, i.e. increase the number cells by reducing cell sizes to the diameter of a typical well (around 2' x 2') to have the numerical model address such a localized question. Not only would such a change dramatically increase the amount of work and time in constructing a new model grid and boundaries but heterogeneities and anisotropies would play a more significant role at smaller scales and increase the difficulty in calibration. If and once this is achieved then an additional difficulty would need to be addressed. Localized ground-water-level changes in pumping cells are further complicated by well efficiencies and the effect aquifer dewatering has on calculating such efficiencies (Driscoll, 1986). Such analysis estimates the increase in actual well drawdown beyond theoretical *aquifer* or *regional* drawdowns due to well inefficiency. MODFLOW does not account for such well efficiencies or aquifer dewatering effects and assumes that wells are 100% efficient. Therefore, one would have to additionally estimate well efficiencies which depend on many factors, some of which have been described earlier in this report. Efficiencies of 70% to 80% are usually obtainable if a well is properly designed, constructed, and developed (Driscoll, 1986) but may be as poor as 50%, where actual pumping well drawdowns would double. Well efficiencies can also change with time. Observation well data away from the turbulent effects of a well are necessary. In all, estimating localized pumping well water-levels requires another level of analysis which is beyond the scope of this report and would also necessitate redefining the grid used for this *regional* model.

The results of the six (6) scenarios according to Table 23, pg. 96, are summarized graphically in Figures 40 through 53 on the following pages. One general statement which can be made is that, except for Scenario 1, in all scenarios the Maunalei tunnel sources will eventually dry up at steady-state conditions. Other statements are now broken down by scenario.

Scenario 1: '42-'94 Average Pumpage

This scenario, steady-state ground-water-levels response to the long-term average pumpage has actually already been covered in the determination of the "best-fit" calibration (see Figure 38, pg. 89). In the plan view, there does not appear to be much difference between the "best-fit" water-level contours (Figure 33, pg. 72) with the water-level contour map for this scenario, Figure 40, pg. 99, except that the areal extent of some higher-level contours are a bit smaller. Drawdown contours shown in Figure 41, pg. 100, show that the regional water-levels should decrease between 50 to 250 ft. with the greatest drawdown near Shaft3/Well 2 and Well 4. The Lower Maunalei Tunnel should have a steady-state flow around 183,000 gpd while the Upper Maunalei Tunnel should dry up if the long-term average pumpage is continued or exceeded and long-term recharge is unchanged. Observed static water-levels and recently reported tunnel flows are regionally consistent with this prediction with the understanding that steady-state has not yet been achieved.

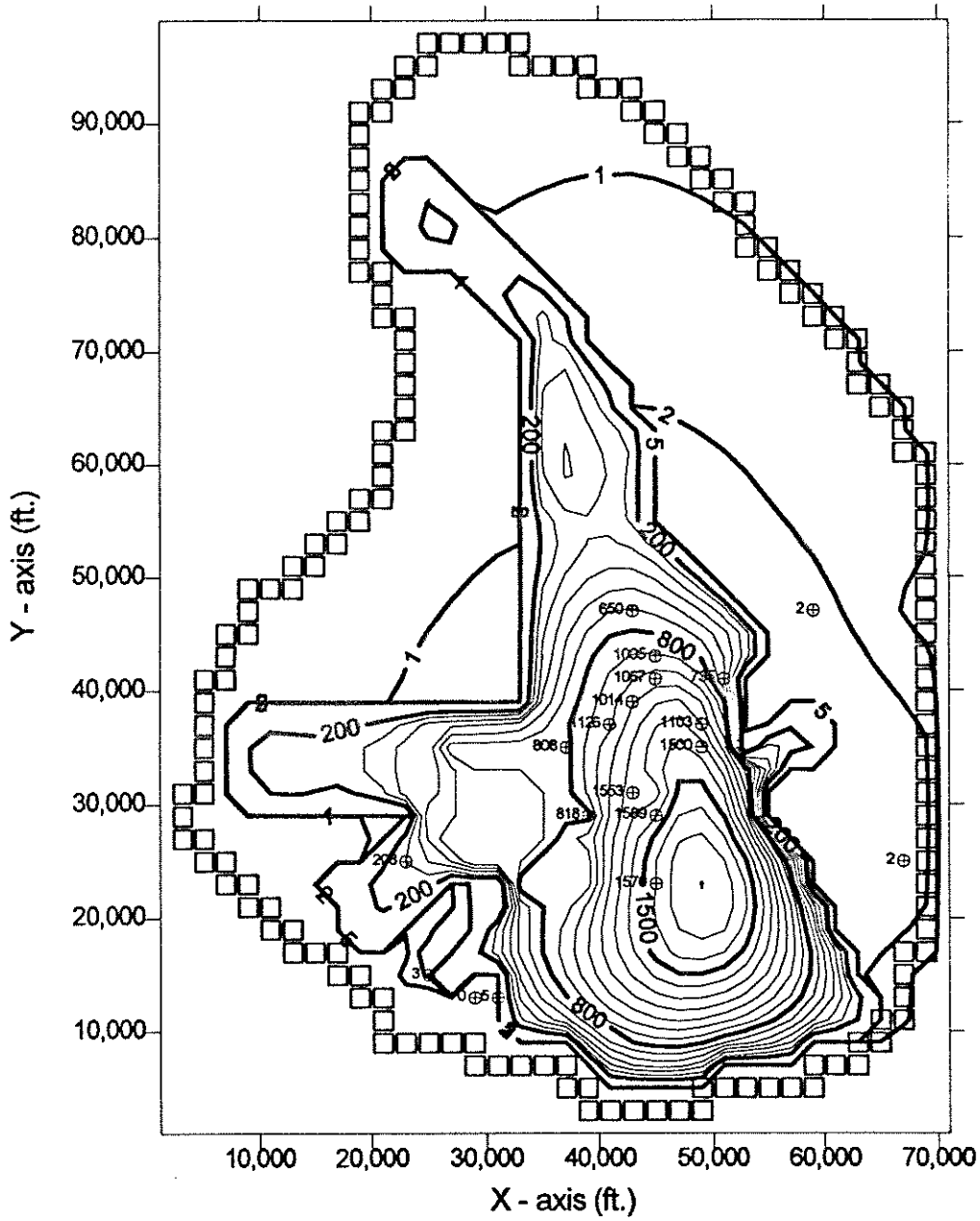
Maximum steady-state regional drawdown predicted by the model is 264 feet. Wells 4 & 5 in recent times have approached this drawdown on particular months and have actually exceeded it during pumping (see Figures 17& 20). Otherwise, no reported static or pumping drawdown has exceeded this value.

The predicted range of time necessary to reach steady-state is on the order of several decades to several centuries. Figure 42, pg. 101, compares observed water-levels with simulated water-levels taken out 1000 years from 1942. This transient figure for other wells is found in Appendix G. Like the other transient runs done during calibration on only the past 50 years, found in Appendix F, there does not appear to be one universal storage coefficient value for all wells. From Figure 42, it can be seen that through various storage coefficients the time needed to reach steady-state is on the order of several decades to several centuries. The transient fit for this source was a storage coefficient of 0.4 which would place this source's steady-state on the order of centuries.

Comparing model predicted regional drawdowns with observed static drawdowns in wells it can be generally said that the range of actual aquifer drawdowns due to long-term pumping is somewhere between 20% to 95% of steady-state drawdowns. This statement is independent of the time necessary to reach steady-state conditions but is only a comparison of steady-state drawdowns predicted. This statement does not apply to Wells 6 & 9 which are relatively new and have very little data compared to other older sources on the island and Well 1 whose recent pumpage is much greater than the historical long-term pumpage averaged over 52 years.

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Best-Fit Calibration with Existing Wells Pumped to '42-'94 Ave mgd



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 1.790 mgd
Flow from Lower Maunalei Tunnel = 0.183 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1803 ft. above mean sea level.
(contour truncated at 1800 ft. above msl)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

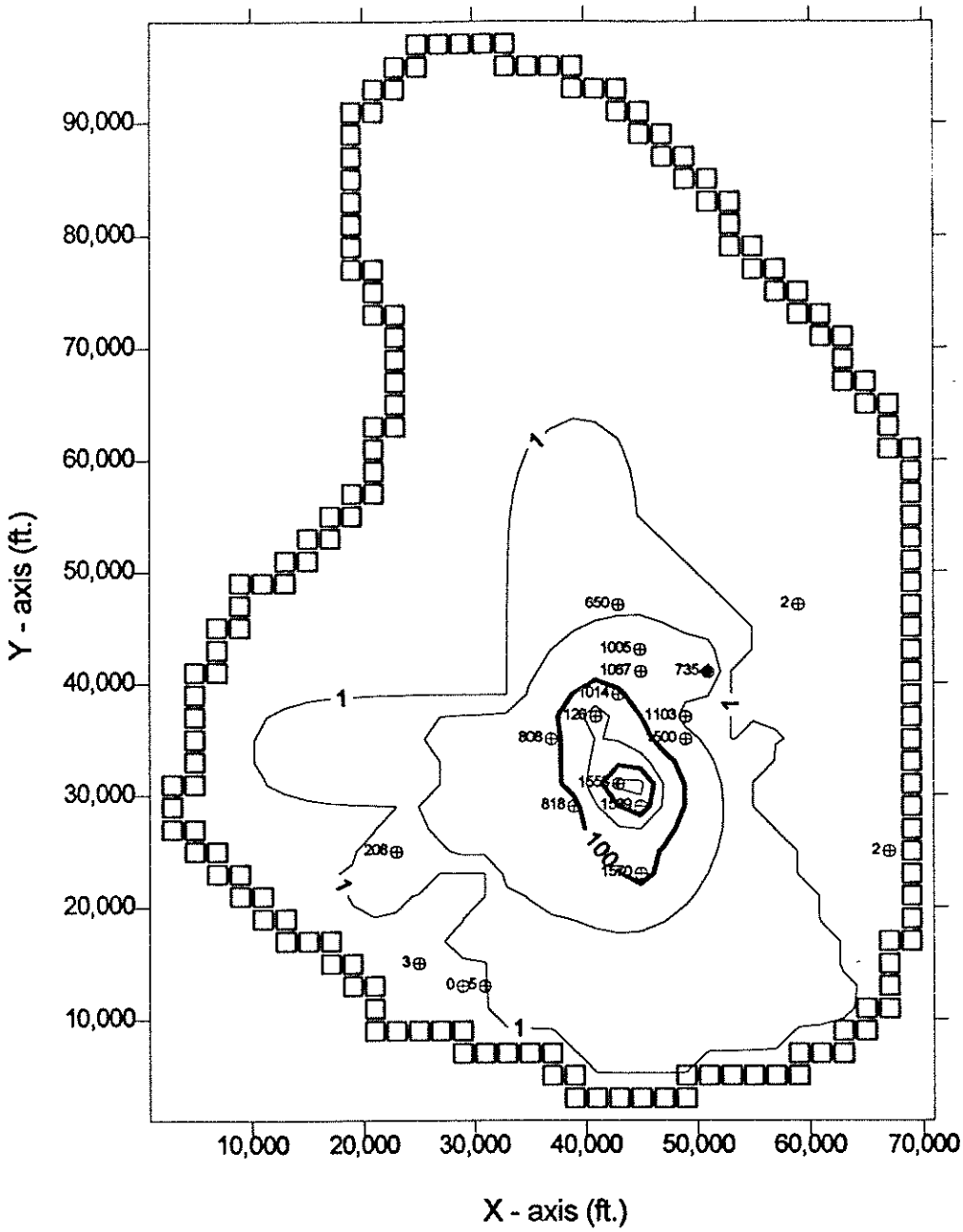
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 40. Scenario 1 Predictive Regional Ground-Water Level Contours

Simulated Regional Steady-State Drawdown Contours for Lanai

Best-Fit Calibration with Existing Wells Pumped to '42-'94 Ave mgd



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 1.790 mgd
Flow from Lower Maunalei Tunnel = 0.183 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown = 264 ft.
(contour truncated at 200 ft.)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 41. Scenario 1 Predictive Regional Drawdown Contours

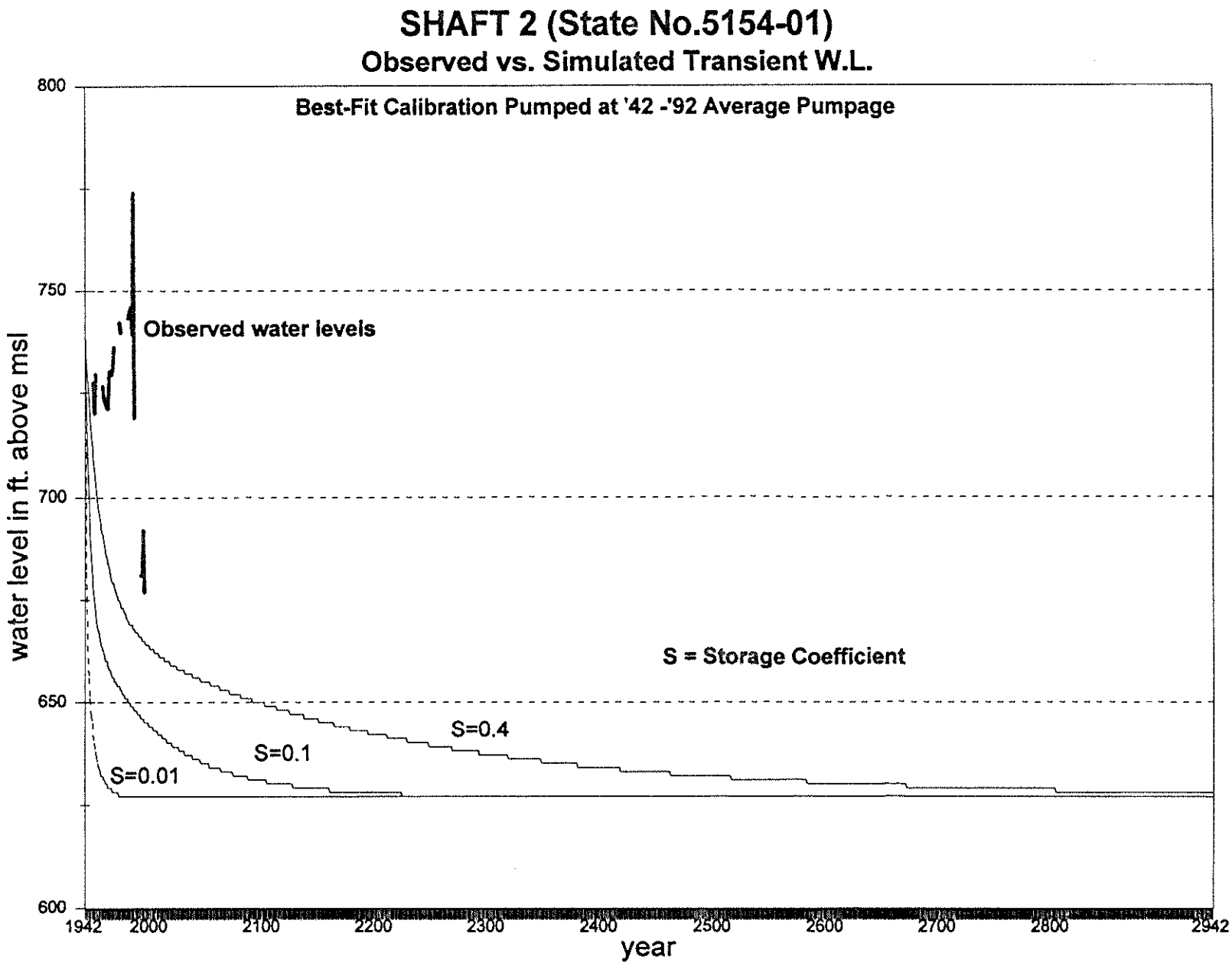


Figure 42. Observed vs. Simulated Transient Water Levels for Shaft 2

Scenario 2: Total Fog Drip (*FD*) Removal

This scenario attempts to filter the impact ***FD*** has on ground-water-levels on Lana'i. To obtain the maximum domain, or envelope, of ***FD*** impacts, all ***FD*** contribution to recharge is removed. This is truly a worst case situation as some ***FD*** will occur even on bare soil and rocks.

If ***FD*** is completely removed from the "best-fit" calibrated model, regional water-levels around existing high-level wells are predicted to drop between 100 to 700 ft. (see Figure 44, pg. 104) and impact a much broader area (see Figure 43, pg. 103) than impacted by the existing long-term pumpage. This greater impact is expected since ***FD*** is estimated at about 8.9 mgd whereas long-term pumpage is around 1.8 mgd. The major impacts are confined within the center most portion of the high-level aquifer (see Figure 50, pg. 112) while the outer fringes of the high-level aquifer are not as affected. This is expected since this is the area above the 2000' elevation where rainfall precipitation is augmented.

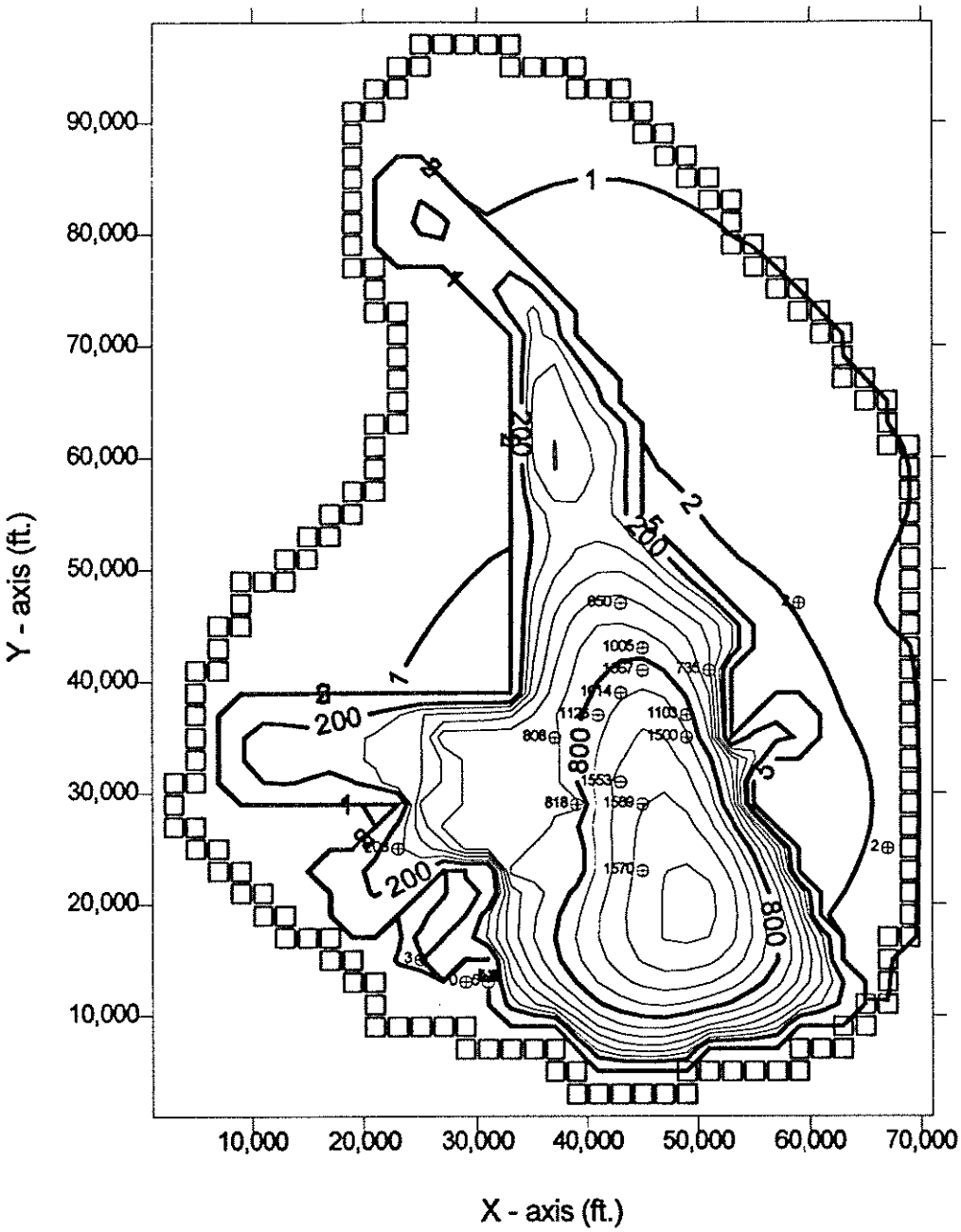
Transient analysis of this scenario, as shown in Figure 45, pg. 105, assumes $S = 0.1$ and indicates that it would take between 400 to 600 years to achieve complete steady-state. However, much of the changes should be seen in the first 100 years of such a drastic change. These two observations indicate that if a significant amount of ***FD*** were reduced in the past 50 years then some of the drawdown seen in the wells may be due to a reduction in ***FD***, but it will also take a long time before the full effects of such a reduction are complete.

The insight provided by this predictive run shows that ***FD***, or some other form of precipitation which augments rainfall, is an important contributor to the ground-water supply on Lana'i. This should not be surprising given the sensitivity of the calibrated model to recharge. Water levels can therefore be greatly affected by this one recharge component alone. In fact, Bowles (1974) had attributed some of the decline in ground-water-levels due to the reduction of forest cover on the island which would have an effect on ***FD*** although other factors such as changes in runoff may be involved. Since ***FD*** is dependant on forest cover this scenario makes a particularly strong case for protecting forest cover, particularly in the regions above the 2000' elevation contour where ***FD*** is more prevalent.

What is most interesting about this particular scenario is that it can be viewed as a potential optimized well configuration scenario. Assuming long-term recharge, including ***FD***, continues, then placing wells at every cell node (i.e. every 2000 ft.) in the region above the 2000' elevation and pumping at a rate which matches the effect of ***FD*** removal at that cell node would result in the same aquifer response as removing ***FD*** only. Thus, such an optimized well configuration could pump 8.9 mgd with similar regional effects as shown in Figures 43 to 45. This does not mean to say that such a well configuration, which itself is questionable considering economics, power, and other physical constraints, would result in fully operational pumpage scheme since localized water-levels depend on other criteria such as well efficiencies or water quality. However, the model suggests that from the aquifer's point of view such an optimized scheme is possible.

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Best-Fit Calibration minus Fog-Drip Only



MODFLOW INPUT DATA

Storage Coeffcient = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 53.10 mgd
Pumping = 0 mgd
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1230 ft. above mean sea level.
(contour truncated at 1200 ft. above msl)

⊖ - Well locations with original water levels.

□ - Numerical coastline of Lanai

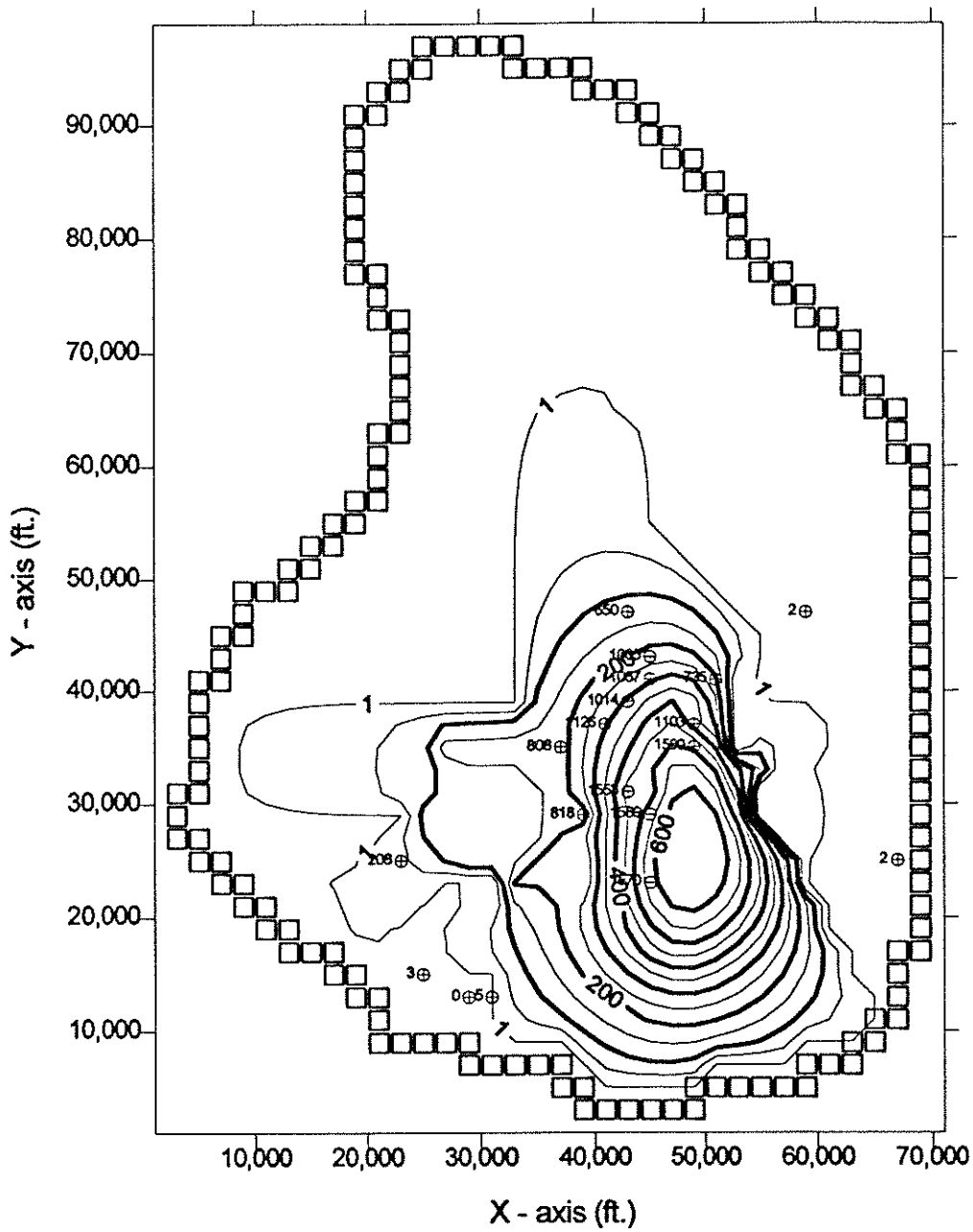
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 43. Scenario 2 Predictive Regional Ground-Water Level Contours

Simulated Regional Steady-State Drawdown Contours for Lanai

Best-Fit Minus Fog-Drip Only



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 53.10 mgd
Pumping = 0 mgd
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown = 679 ft.
(contour truncated at 600 ft.)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 44. Scenario 2 Predictive Regional Drawdown Contours

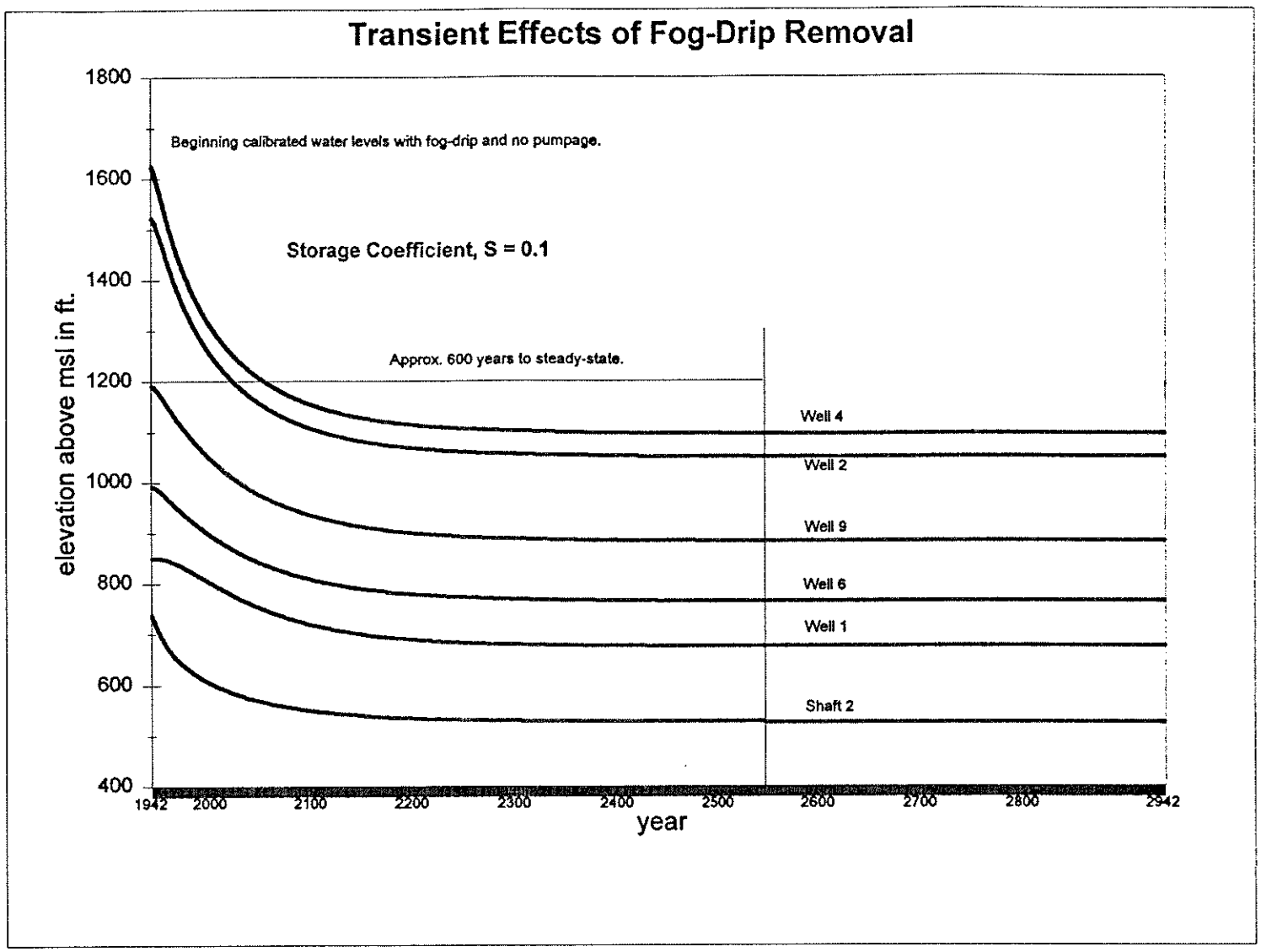


Figure 45. Scenario 2 Transient Time Response to Fog-Drip Removal

Scenario 3: 6 mgd Pumping From Selected Existing Wells

This predictive scenario has its origin in the current CWRM estimate for sustainable yield for the Lana'i. Pumpages for this scenario are defined in Table 23, pg. 96. A plethora of 6 mgd scenarios are possible as one could distribute such pumpage in an infinite number of ways. For purposes of this report, the additional pumpage necessary to bring 1994 well pumpages up to a total island pumpage of 6 mgd was distributed equally as possible amongst such pumping sources.

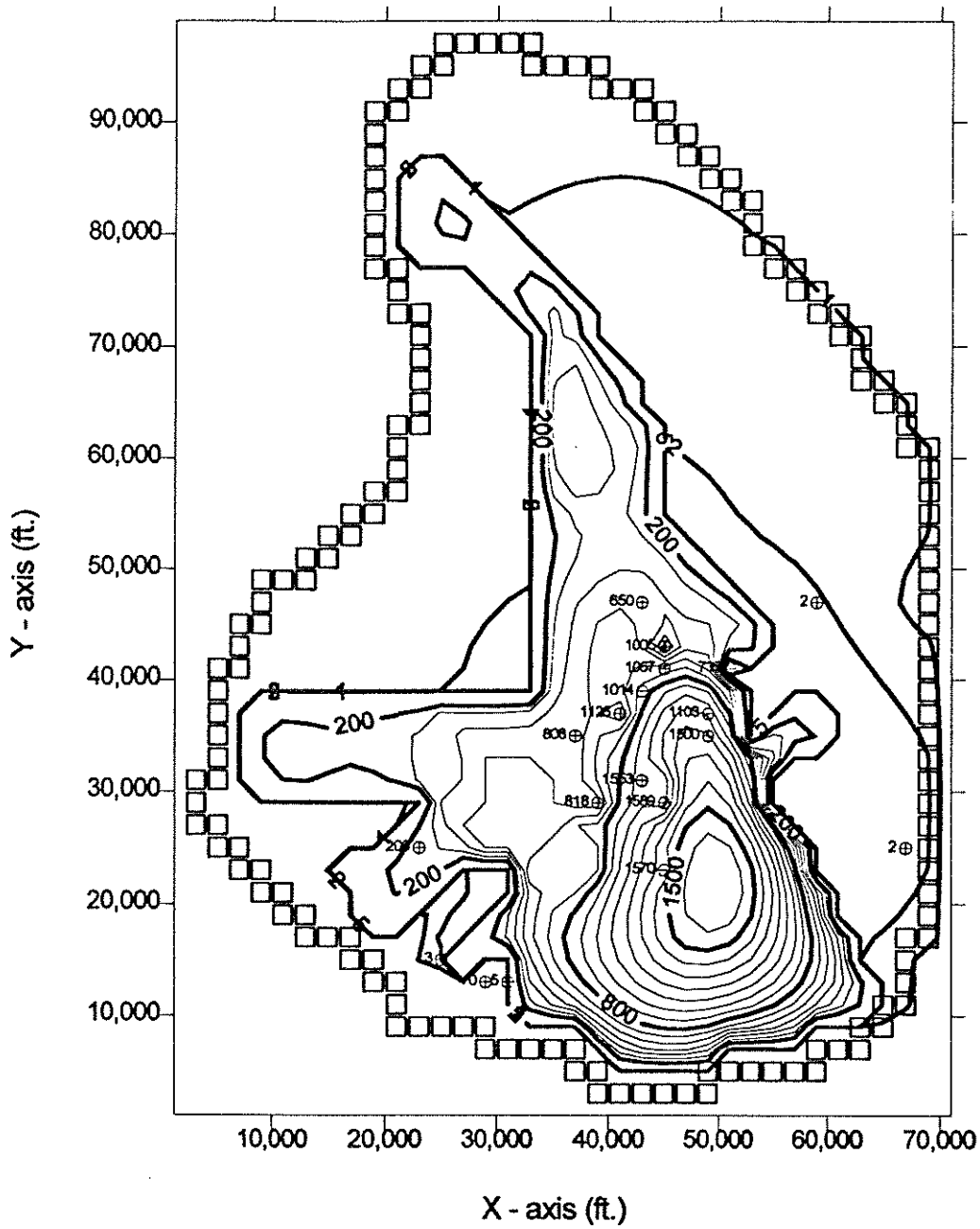
On the regional scale, pumping selected existing wells to 6 mgd results in regional drawdowns between 50 to 950 feet over a larger area than the long-term pumpage effects but a smaller area than what the model predicts for Scenario 2; total ***FD*** removal. Figures 46 & 47 show this clearly when one compares these with the corresponding Scenario 2 figures. This is expected since drawdowns due to 6 mgd pumping through a limited number of wells, rather than spreading a greater flux removal, total ***FD***, over a larger area, should be more concentrated.

In broad areas around the existing wells regional water-levels would decrease on the order to 300 to 500 feet with the maximum drawdowns occurring at Shaft 2. In fact, the model predicts that aquifer water-levels at Shaft 2 would go below sea level which would probably render this source unusable. This was the same well problem encountered before GIS recharge was incorporated into the model. The historical behavior of this source does not indicate such a drastic event would result and probably indicates that there are some unresolved local effects associated with this source. Additionally, the lower Maunalei Tunnel would cease to flow.

Although regional water-levels remain high at steady-state for this scenario it does not mean the 6 mgd can be achieved under the current well configuration. Again, localized effects will increase drawdowns at the specific well sites and would necessitate the deepening of all existing wells which do not reach sea level. Even such a modification may not be enough to develop 6 mgd from the aquifer and additional wells would probably be required.

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Best-Fit Calibration with Existing Wells Pumped to 6 mgd



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 6 mgd
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1689 ft. above mean sea level.
(contour truncated at 1600 ft. above msl)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

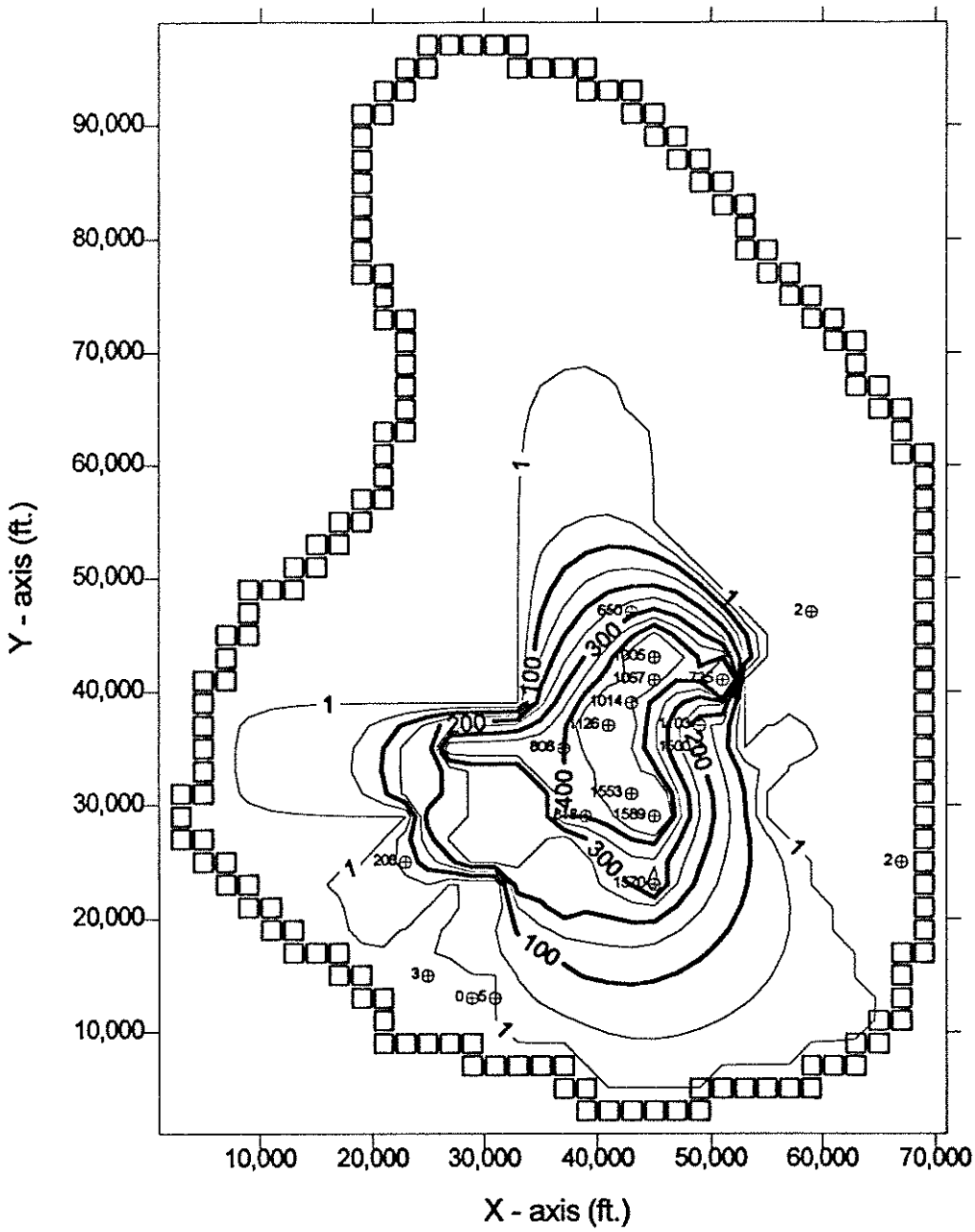
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 46. Scenario 3 Predictive Regional Ground-Water Level Contours

Simulated Regional Steady-State Drawdown Contours for Lanai

Best-Fit Calibration with Existing Wells Pumped to 6 mgd



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 6 mgd
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown = 942 ft.
(contour truncated at 450 ft.)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 47. Scenario 3 Predictive Regional Drawdown Contours

Scenario 4: Combined *FD* Removal & 6 mgd Pumping Scenarios

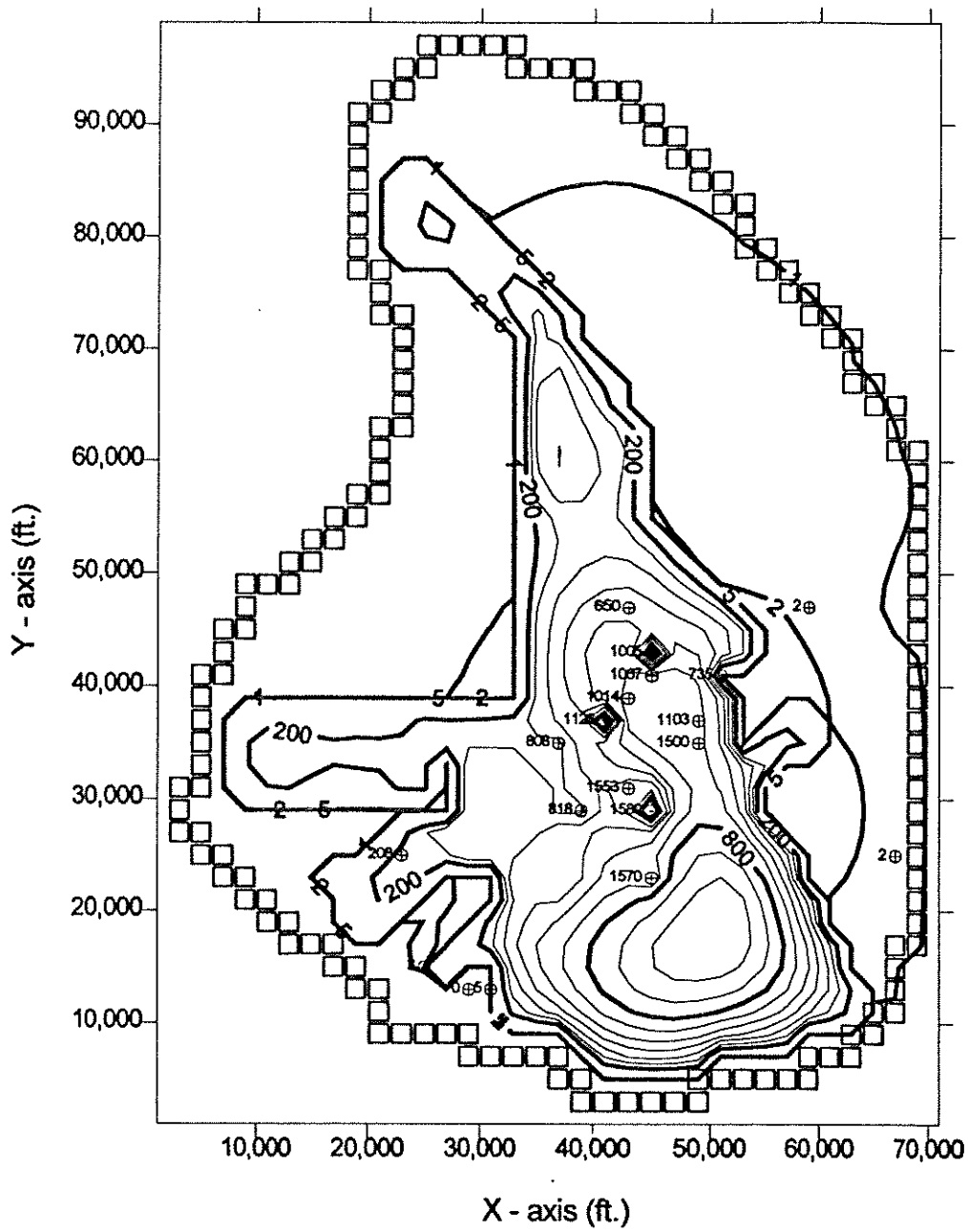
Scenario 4 is the combination of scenarios 2 & 3. Figure 48, pg. 110, shows that regional water-levels are greatly affected throughout the high-level area with high drawdowns located around several existing wells. Figure 49, pg. 111, shows the spatial distribution of drawdowns with maximum regional drawdowns in excess of 1300 ft. Regional water-levels would reduce the utility of many wells as they reach or go below sea level. This is not unexpected since the total stress delivered to the aquifer is equivalent to a 14 mgd pumping scenario which is over twice the next nearest sustainable yield estimate ever made for the island. However, even at this elevated pumpage scenario the model predicts regional water-levels would remain near 1000 ft above sea level but on the windward side of the island only.

One technical problem with this scenario is that many cells in the model actually dry up which induce error into the results. In the particular version of MODFLOW used, once cells dry up during an iteration solution they become inactive. This, in turn, reduces transmissivities in the model which may cause error in other parts of the grid. There is a module which allows MODFLOW to re-wet a cell which has dried up during an iteration but experience with this modular package resulted in a decision to leave this particular feature out of the model. Another way to address this problem is to reduce the time-step size to avoid large numerical oscillations as the model attempts to reach a solution. This was approach was not fully investigated but assuming cells which do go dry should is conservative. Despite the is drawback, the model shows that the combination of total ***FD*** removal combined with a 6 mgd pumping scenario results in a drastic reduction of regional water-levels on the leeward side of the island.

For a different perspective, Figure 50, pg. 112, was produced to compare water resulting water-level responses between scenarios 2-4. Using the same A-A' profile shown earlier in Figure 36, pg. 86, profiles were constructed along this base profile line to compare scenarios 2-4. As can be seen in Figure 50, greatest changes occur near the center of the island where the majority of recharge is concentrated. As one moves away from the center of the island water-level responses become more attenuated, especially when one moves outside the high-level area and into the basal portions of the island's ground-water system.

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Existing Wells Pumped to 6 mgd & Fog Drip Removed



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 53.1 mgd
Pumping = 6 mgd (4.2 - some wells go dry)
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1096 ft. above mean sea level.
(contour truncated at 1000 ft. above msl)

⊖ - Well locations with original water levels.

□ - Numerical coastline of Lanai

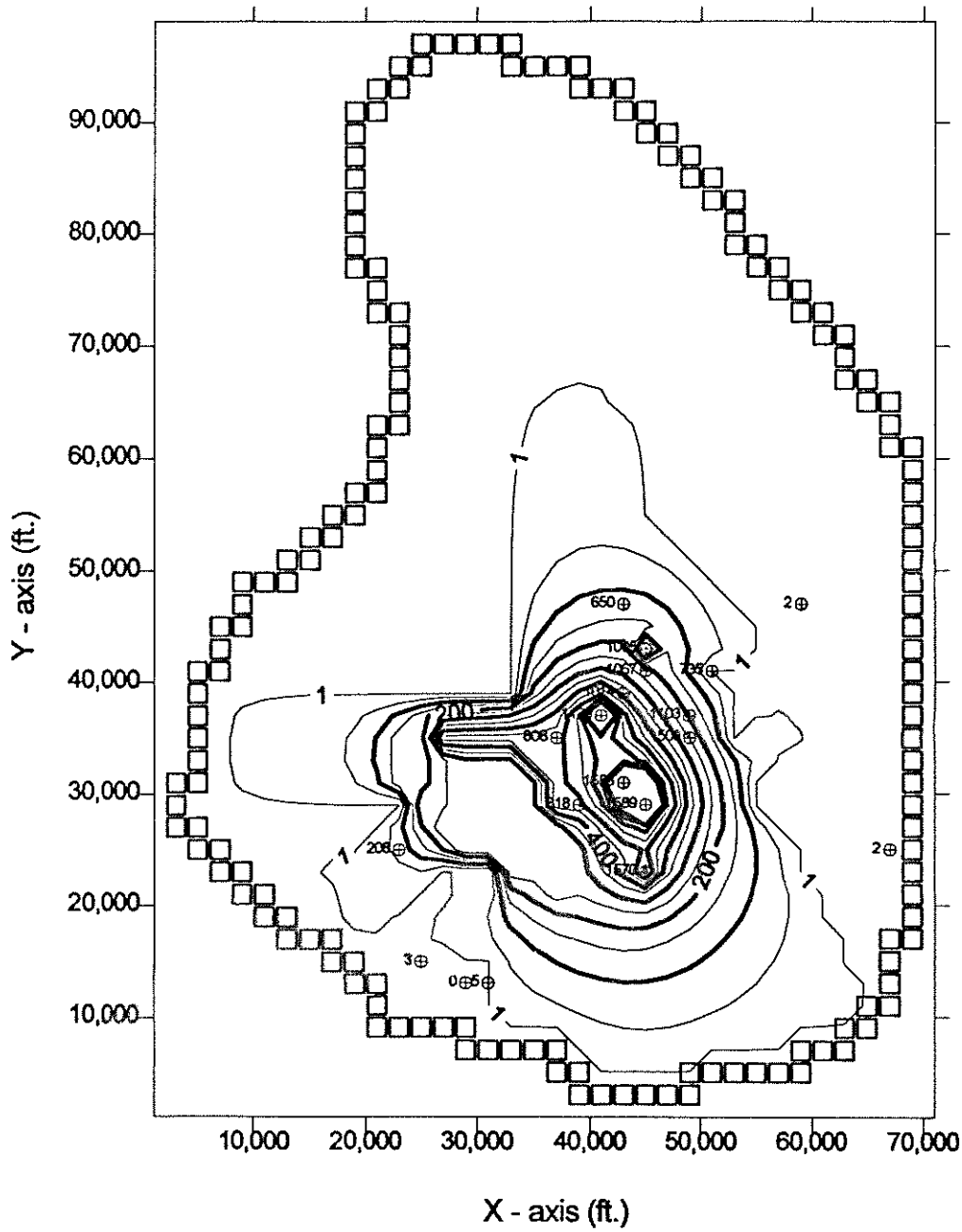
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 48. Scenario 4 Predicted Regional Ground-Water-Level Contours

Simulated Regional Steady-State Drawdown Contours for Lanai

Existing Wells Pumped to 6 mgd & Fog Drip Removed



MODFLOW INPUT DATA

Storage Coeffcient. = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 53.1 mgd
Pumping = 6 mgd (4.2 as some wells go dry)
Flow from Lower Maunalei Tunnel = 0.000 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown = 1309 ft. above mean sea level.
(contour truncated at 700 ft.)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 49. Scenario 4 Predictive Regional Drawdown Contours

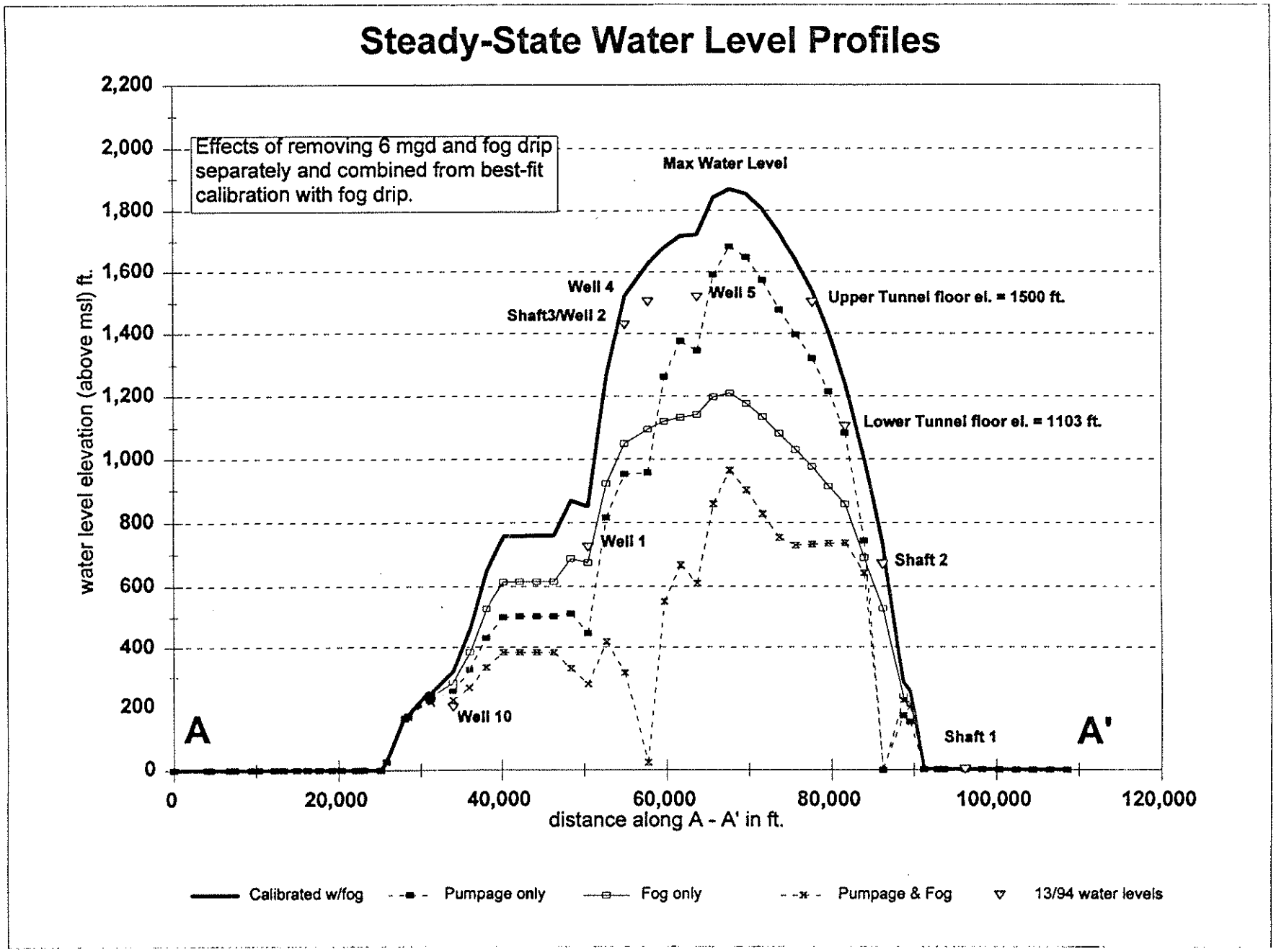
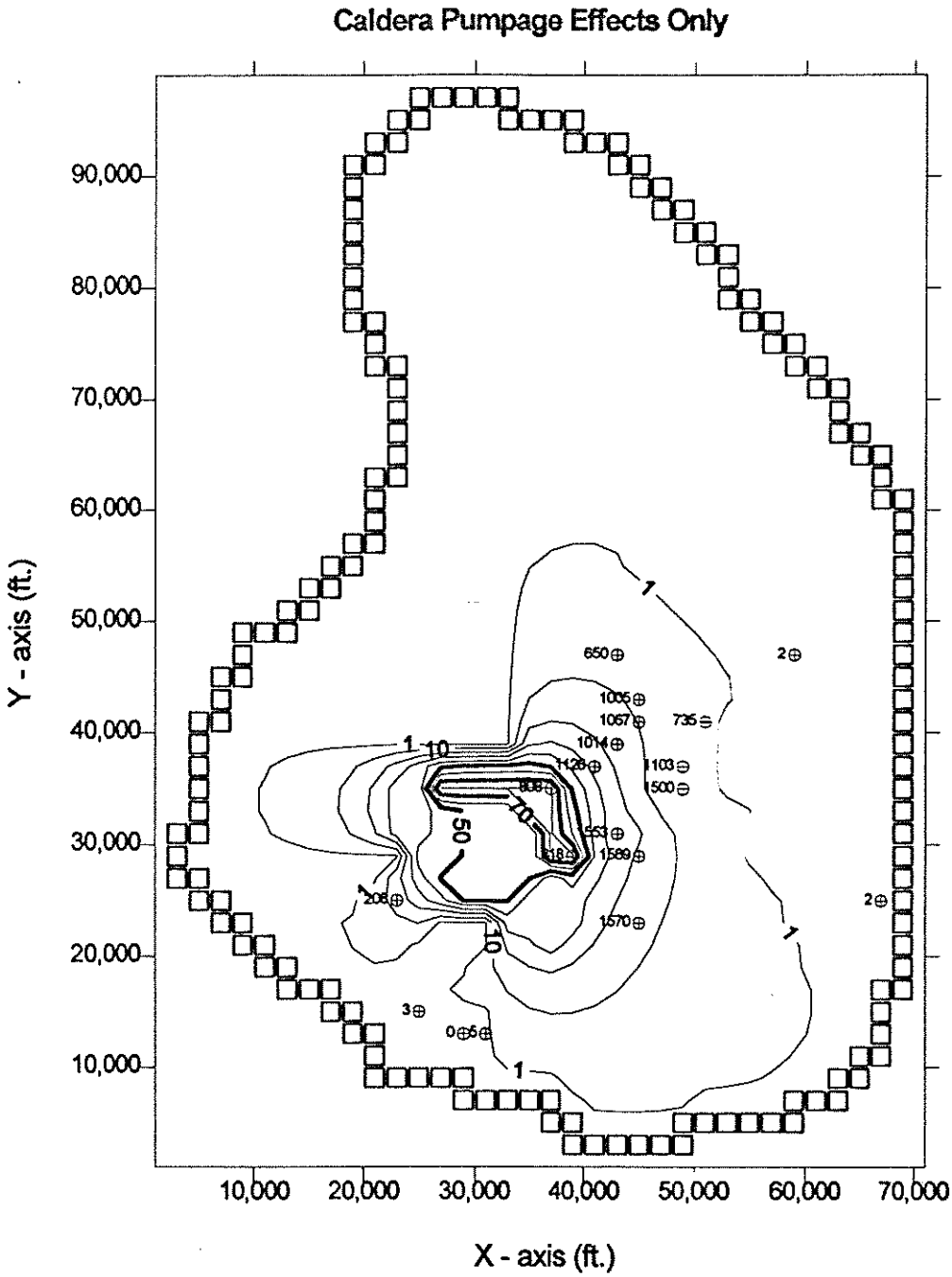


Figure 50. Scenarios 2, 3, & 4 Predictive Profile A-A' of Ground-Water Levels (see Figure 36, pg. 86)

Scenario 5: Palawai Caldera Pumpage Impacts

This scenario is based on the concern over the impact of pumping wells 1 & 9 (and the soon to be completed Well 14). Chlorides in Well 1 have decreased with increasing pumpage which indicates that fresher water is being supplied to the well and raises concern over the impact on upgradient sources.

Figure 51, pg. 114, shows the steady-state drawdown contours associated with pumping just wells 1 & 9 to assess their impact on the aquifer. To filter out effects of other well pumpage all other wells are turned off for this scenario. As can be seen, in the caldera region a total pumpage of 0.650 mgd would have a regional drawdown of about 50 ft. with a maximum drawdown of about 80 ft. Other wells upgradient would see steady-state regional drawdowns of about 10 to 30 ft. due to the caldera pumpage. Given the general sensitivity of the high-level wells to local pumpage and climactic events, it would be reasonable to "miss" or not see the effects of the caldera pumpage due to the normal variation in water-levels. In other words, the relative effect of caldera pumpage is such that pumpage and the climate would have to be very steady over a reasonable long period to measure the effects of caldera pumpage in upgradient sources. Also, sensitivity analysis (see Figure 39, pg. 95) has shown that the model is insensitive to caldera permeability, probably due to the small region it covers compared to the entire island. Generally speaking, the model predicts that the effects of caldera pumpage on upgradient well regional water-level are relatively small.



MODFLOW INPUT DATA

Storage Coeffcient = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 0.650 mgd (caldera only)
Flow from Lower Maunalei Tunnel = 0.256 mgd
Flow from Upper Maunalei Tunnel = 0.036 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown = 82 ft.
(contour truncated at 80 ft.)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 51. Scenario 5 Predictive Regional Drawdown Contours

Scenario 6: A Potential Plan of Future Pumpage

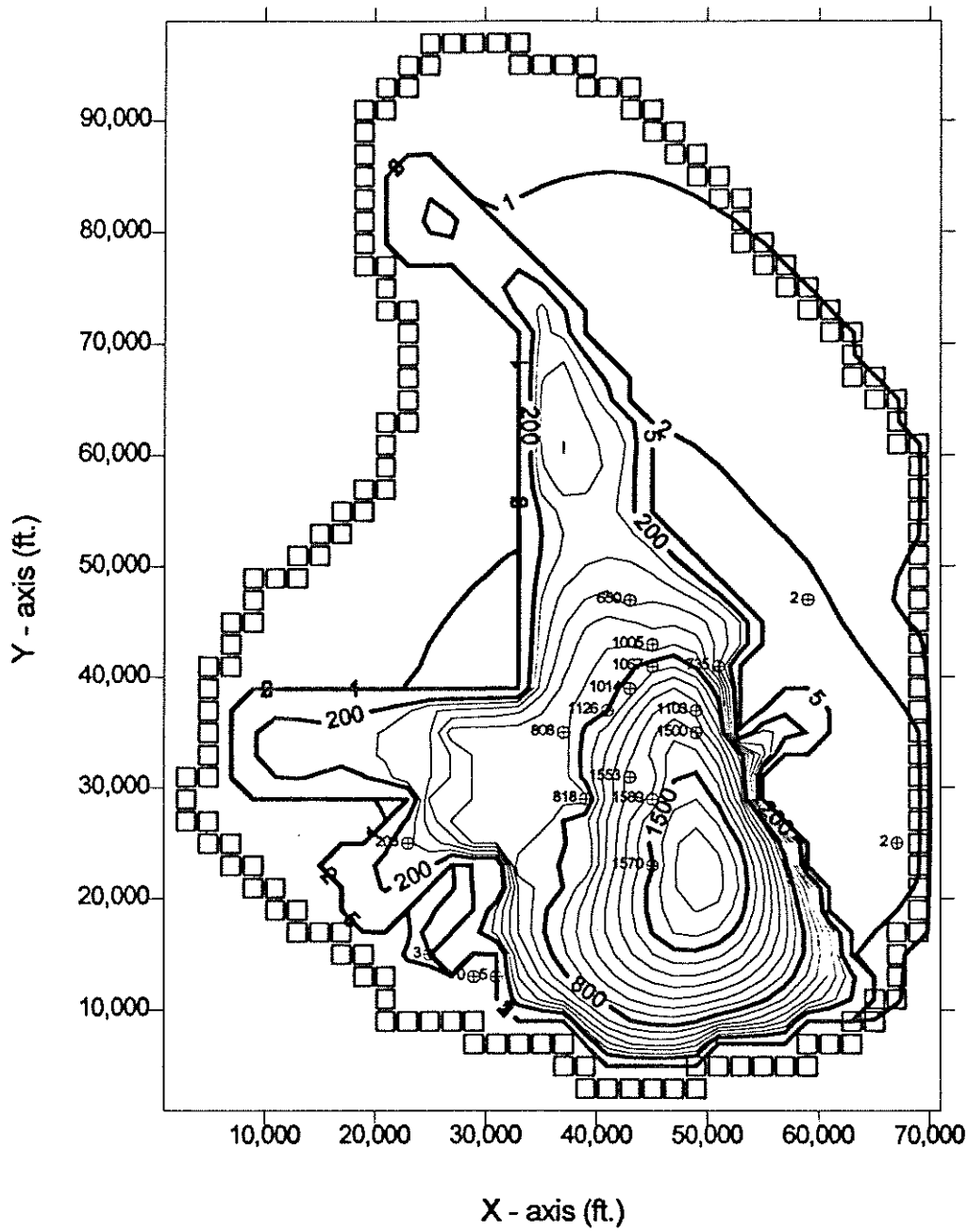
The pumpage distribution for this scenario has been supplied by LCo. which should provide a more realistic pumping scenario for the future. The pumpage scenario is only one possible distribution of average pumping at each existing source with the addition of the new Well 14 (State well no. 4854-02) which is under construction and will be intergrated with wells 1 & 9.

Results of this predictive run are shown graphically in Figures 52 & 53 on the following pages.

As expected, the resulting regional water-levels fall between the extremes of long-term pumping and scenarios 2, 3, and 4. Given the existing infrastructure some wells may or may not need to be deepened depending on the actual well losses incurred at higher pumpage rates. No existing well in this scenario is predicted to have its water-level decline to sea level.

Simulated Regional Steady-State Ground Water Level Contours for Lanai

Existing Wells Pumped to 3.520 mgd



MODFLOW INPUT DATA

Storage Coeffcient = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@ z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 3.520 mgd
Flow from Lower Maunalei Tunnel = 0.103 mgd
Flow from Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum water level = 1761 ft. above mean sea level.
(contour truncated at 1700 ft. above msl)

⊕ - Well locations with original water levels.

□ - Numerical coastline of Lanai

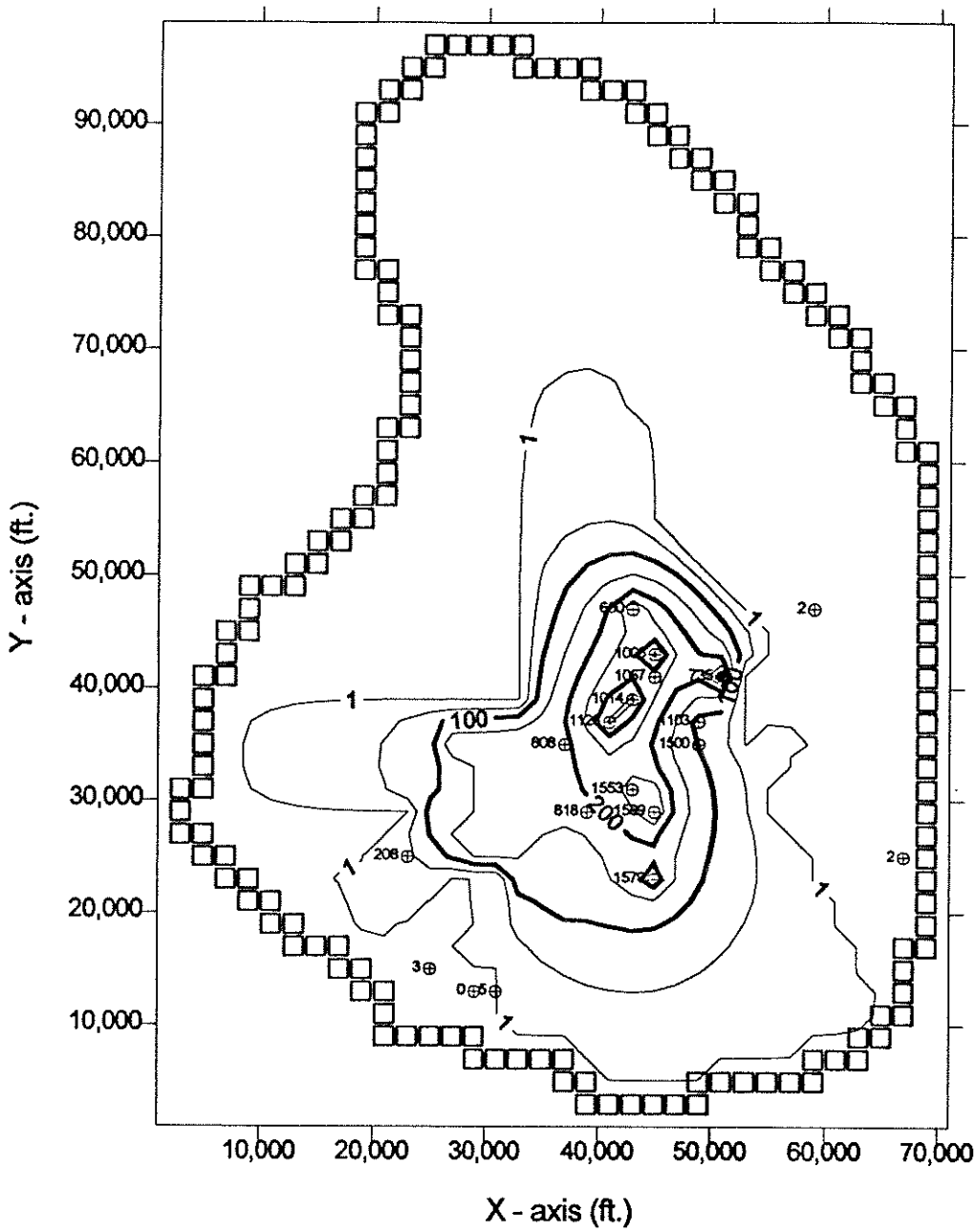
CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 52. Scenario 6 Predictive Regional Ground-Water Level Contours

Simulated Regional Steady-State Drawdown Contours for Lanai

Best-Fit Calibration with Existing Wells Pumped at 3.520 mgd



MODFLOW INPUT DATA

Storage Coeffcient = 0 (i.e. non-transient)
Global Kh = 1000 ft/d
Caldera Kh = 100 ft/d
River conductance Klw/m
with lw=4,000,000 sq.ft.,m=100 ft.,@z=0 ft. msl
where South K=1000 ft/day = 400,000,000 sq.ft./day
where North K= 0.1 ft/day = 40,000 sq.ft./day
Horizontal flow boundaries = 895
Horizontal flow boundary conductance K/w = 0.0000501/day
Bottom elevation = -400 ft.
Area of recharge = 140.83 sq. mi.
Recharge = 61.60 mgd
Pumping = 3.520 mgd (Lanai Co.)
Flow in Lower Maunalei Tunnel = 0.103 mgd
Flow in Upper Maunalei Tunnel = 0.000 mgd

MODFLOW OUPUT THROUGH SURFER GRAPHICS

Maximum drawdown =360 ft. from long term steady-state.
(contour truncated at 350 ft.)

⊕ - Well locations with original water levels.

□ - Numerical Coastline of Lanai

CLOSURE CRITERIA

Maximum water level change < 0.001
Water balance < 1% (Actual = -0.05%)

Figure 53. Scenario 6 Predictive Regional Drawdown Contours

Summary of Predictive Scenario Results

Table 24 below summarizes the steady-state results for individual wells for the various predictive runs rather than the island profiles shown earlier. The reader is reminded that the best-fit aquifer parameters found in Table 16, pg. 81 are the base upon which the various stress scenarios are imposed. It is important to realize that the water-levels predicted are regional and are more relevant to the aquifer water-level response rather than the actual pumping water-level response in each well for reasons explained earlier. Also, the reader is reminded that transient analyses has shown that there are definitely heterogeneities at the local well scale (see Table 22, pg. 93) which also add to the uncertainty water-levels in actual well sites.

Table 24. Summary of Predictive Ground-Water System Responses

Source	Steady-State Water-Level Elevation above mean sea level in ft.						
	Highest Observed Period 13 1994	Scenario					
		1 '42-'94 Ave.	2 No Fog-Drip	3 Pump 6 mgd	4 6 mgd & no FD	5 Palawai Caldera only	6 Lanai Co.
Shaft 2	681	627	527	-204	< -400	735	412
Well 1	[a]729	765	675	449	275	768	662
Well 2/Shaft 3	1426	1259	1050	953	315	1502	1254
Well 3	1024	974	861	412	< -400	1127	796
Well 4	1503	1390	1096	957	26	1606	1326
Well 5	[b]1519	1604	1143	1345	608	1709	1492
Well 6	1026	915	764	190	< -400	983	631
Well 9	721	762	672	447	275	764	658
	Steady-State Tunnel Gravity Flow in mgd[c]						
Lower Tunnel	0.005	0.183	0.000	0.000	0.000	0.000	0.103
Upper Tunnel	[d]0.000	0.000	0.000	0.000	0.000	0.000	0.000

a. As of October 1994
b. As of November 1993
c. million gallons per day
d. As of January 1991

A summary of the results for each scenario which considers transient results of each predictive run is as follows:

1. Water level changes from long-term pumpage are between 20% to 95% complete in terms of present water-level changes compared to steady-state water-level changes predicted by the model. However, the Upper Maunalei Tunnel is predicted to cease flowing at the continued long-term pumping rate. Although no one regionally homogeneous storage coefficient can used, it appears that water-level changes due to long-term historical pumpage of 1.790 mgd should be complete on the order of centuries.

2. Total removal of fog-drip would have a more impact on water-levels in the high-level aquifer area than the overall long-term pumpage. Fog-drip, or whatever phenomena accounts for precipitation above observed rainfall, has a major role and impact on observed water-levels. Assuming a storage coefficient of 0.1, the middle value of best matches from transient analysis on all wells with sufficient data, a total fog-drip removal event would take between 400 to 600 years to fully impact water-levels with changes between 100 to 700 ft. depending on location of existing well. Both Maunalei tunnels would cease to flow.

3. Pumping 6 mgd from existing sources will create greater regional drawdowns in some areas than if fog-drip alone stopped altogether. However, pumpage patterns would have to be modified as under this scenario's distribution Shaft 2 may lose its present utility. Still, it may be possible to develop 6 mgd from the aquifer without harming the resource although not without major modifications to existing wells, additional well development, and carefully managed pumping distributions and schedules. Both Maunalei Tunnels would cease flowing at this island pumpage rate.

4. Pumping 6 mgd from existing sources <u>and</u> losing all fog-drip would result in several existing wells losing their potential utility and both tunnels would cease flowing.

5. Pumping caldera wells 1 and 9 an average of 0.325 mgd each for a total of 650,00 gpd would have relatively small impacts on upgradient wells and such impacts would be difficult to differentiate from natural water-level changes.

6. Pumping 3.520 mgd from existing wells does not harm the aquifer. However, some changes in the existing well infrastructure may still be necessary as some of the wells specified for future pumping have no track record of water-level response to such stresses. The lower Maunalei Tunnel should continue to flow with an average flow of 0.103 mgd. However, the model predicts that the Upper Maunalei Tunnel would cease flowing at this island pumpage rate.

Prediction Sensitivity Analysis

No predictive sensitivity analysis was performed outright due to time constraints. Instead, it is anticipated and most probable that the model will have the same sensitivity to the horizontal flow boundaries and recharge as found in earlier sensitivity analyses. However, it is evident that the distribution of pumpage is an important factor in resulting ground-water-level responses according to the numerical model.

Model Limitations

The limitations of the model are based upon the assumptions and uncertainties associated with the construction and calibration of the model. These assumptions and uncertainties do not invalidate the model but do provide important caveats which should be kept in mind when interpreting the results of the model. A synopsis for the assumptions and uncertainties which were described in the body of this report are listed as follows:

SUMMARY OF ASSUMPTIONS AND UNCERTAINTIES

1. The Lana'i ground-water model is classified as an identification or "inverse" type problem. Inverse type problems are where stresses, like pumpage, and the resulting responses, or resulting water-levels, are known, but the aquifer system is unknown. Unfortunately, inverse type problems do not have unique solutions, and especially when the model is a "simplified" or "effective average" version of the real world. Additionally, the "inverse" problem must be solved before a prediction problem can be solved (Bear,& others, 1992).

2. Sources of error can originate in the conceptual model, the numerical analysis, and the input data. Errors in these three general areas are cumulative. Additionally, it is hard to differentiate errors between the three once they are integrated.

3. Conceptual errors could arise if significant perched conditions exist on Lana'i since the model does not consider this possibility. Additionally, the model does not consider that differences in the ground-water fluid from the geothermal activity in the Palawai Basin.

4. Numerical errors arise mainly from the interpolation of nodal values which for Lanai's case are water-levels and thus depend on nodal spacing. Ideally, actual data values should coincide with nodal location. In this model cell areas cover one-seventh of a square mile and wells are not exactly located at the node of the cell. This type of interpolation error can be as much as 10 ft. or more (Anderson & others, 1992).

5. Another source of error is the GIS recharge calculation based on geographic information. There are over ten (10) sources of error associated with the accurate projection of any map. However, since the island of Lana'i is relatively small this cartographic error is assumed to be small. Also, the GIS is an improvement over earlier studies which were based on outdated projections.

6. For any field measured data input (head, rainfall, evaporation, recharge, etc.) sources of error include transient effects, measurement technique, scaling effects.

7. Must be aware that there are differing structures at different scales. The Lana'i ground-water model is looking at the entire island scale which may differ from the smaller scale of individual localized well sites and results from their pump tests. Such "scaling-up" may be erroneous.

8. Regional homogeneity and isotropy is assumed for the regional scale of the island which may or may not be invalid.

9. Setting boundary conditions is the area most prone to serious error. Many unknown dike boundary locations may render uniform distribution of "effective" barriers to horizontal-flow erroneous. Boundary effects of faulting are not accurately known. They could provide either an impediment or a more permeable conduit in some local situations.

10. Dike inclinations or dips are assumed to be vertical. This is not usually the case in Hawaiian volcanics as evidenced by dike systems examined in Windward Oahu and Kilauea, Hawaii.(Walker, 1987). This could invalidate single layer approach of the model.

11. Rates and spatial variations and conditions of leakage between boundaries are unknown.

12. Effects of geothermal activity on water viscosity, density, and water-levels in the Palawai Basin, or elsewhere, are not directly addressed. Density in MODFLOW is assumed constant. Realistically, however, effects of this on water-levels are probably less than 0.6%.

13. Resistivity analysis is of limited value and the presence of dikes and faults may invalidate interpretive results. Additionally, thickness and resistivity of interpreted layers are not independently well determined by resistivity analysis; only the product of the two. On the other hand, it may mean that the Ghyben-Herzberg relationship may not be applicable to the high-level water on Lana'i.

14. It is important to understand that it is the combination of dikes, faults, and rock contained within the dike complex which is most important rather than the individual hydrologic characteristics of each compartment. This is an argument, of course, for the simplified conceptual formulation of the model.

15. Variability of areal distribution (spatial heterogeneity) and annual averages based on monthly variability (temporal variability) for total rainfall, RF, fog-drip, FD, direct runoff, DRO, changes in soil-storage, ΔSMS, and evapotranspiration, ET, to calculate recharge, R, introduces more complexity, hence chance for subjective error.

16. Assuming maximum root-zone information is uniform throughout soil areas may induce significant error in actual evapotranspiration, ET_a, estimates for calculating individual cell recharge values.

17. Irrigation return, ***IR***, was ignored in calculating cell-by-cell recharge values.

18. Direct surface runoff, ***DRO***, constrained within topographical depressions is not considered. Although preliminary GIS analysis indicates that this does not appear to induce a major significant error (underestimation) of recharge, ***R***, in the Palawai basin area, the cumulative effects of island-wide depressions are unknown.

19. Pineapple reduces evapotranspiration, ***ET***, rates by about 20% (Ekern, 1960) but is ignored.

20. Pan evaporation is assumed to equal potential evapotranspiration, which is technically incorrect.

21. Direct measurements for actual evapotranspiration, ET_a, and direct runoff, ***DRO***, are lacking and must be estimated indirectly through soil-storage, ΔSMS, information which has limited actual data sampling.

22. Although the boundaries in this model may be good under steady-state conditions they may not hold true under transient (i.e. pumping) conditions (Anderson, & others, 1992). Under transient conditions initial hydrologic boundaries may change in response to stresses imposed under transient conditions which will result in errors. This is especially true where the bottom of the aquifer on Lana'i is defined by the water-level dependent Ghyben-Herzberg relationship.

23. Variability in pumpage from well to well and year to year is the norm and predictive analysis assumes constant average pumpage.

24. Assumptions made in determining global T, K, S from pumping tests on Lana'i are as follows:

    a. Aquifer is homogenous and isotropic.
    b. Aquifer is infinite.
    c. Position and nature of aquifer boundaries.
    d. Occurrence and nature of confining beds.
    e. Thickness of aquifer is known.
    f. Fluid is homogeneous.
    g. Flow to well is uniform and horizontal only.
    h. Ideally, wells are fully, not partially, penetrating into the aquifer.
    i. Length of aquifer pump test period is adequate.
    j. Pumping rate is constant.
    k. Well losses vs. aquifer losses are known.
    l. Nominal vs. effective radius of well are known.

25. As stated by others, (El-Kadi, & others, 1985, Anderson & Woessnor, 1992) complete equivalence in hydraulic behavior between the true heterogeneous or nonuniform medium in the field and a model's homogeneous uniform medium is obviously impossible. Therefore, overall model input values are "averaged" and not necessarily true or accurate values. This is the attempt to define "effective" parameters which try to preserve observed hydraulic behaviors.

26. MODFLOW does not simulate a 2 fluid system of freshwater floating on the more dense salt water which is known to exist in basal aquifers. However, this problem should not significantly affect the ground-water flow system in the dike-confined regions of the aquifer.

27. The lack of a single "effective" regional storage coefficient, S, makes the validity of the initial assumptions of regional homogeneity and isotropy doubtful.

28. Evaluation of a model is based on 1) The amount, distribution, and quality of information used; 2) methods and criteria used to calibrate the model; and 3) post-auditing. Obviously, a post-audit for this model cannot occur for the next several years.

29. Due to all the previous reasons above, resulting regional water-level responses cannot be directly related to localized individual wells. Individual well responses will probably be both more and less than that predicted by the numerical model.

Conclusions and Postaudit

Due to the higher level of precision required in developing the Lana'i numerical ground-water model, it has been shown that there is a wealth of historical information and hydrologic studies on the island. There are a minimum of forty-five (45) historical hydrologic and geologic studies about Lana'i and numerous hydrologic consultant reports by Anderson. Additionally, Lana'i has one of the few fog-drip studies ever done in Hawaii to quantify the augmentation of rainfall precipitation at higher elevations. Most importantly, there is a long record (over 50 years) of rainfall, pumpage, and both pumping and non-pumping water-level data which is unique in its the island-wide completeness in Hawaii. This fact is important since other hydrologists have argued that numerical models are many times invalid since they are not 'closed' systems (Oreskes, & others, 1994). Since the entire island of Lana'i is modelled with much of the historical data known it is as 'closed' a system one may find in Hawaii and may be an important contributing factor to the model's success of matching regional ground-water-level responses.

Despite all the possible sources of error, pitfalls, and lack of data associated with numerical models in general, the Lana'i numerical model does a reasonably good job of reproducing the observed steady-state ground-water behavior with reasonable flow parameters based on the existing data and similar information from other studies in Hawaii. Other numerical models in Hawaii have also been able to reproduce the complex hydrologic behavior of aquifers at the regional scale (Souza & Voss, 1987; Eyre & others, 1986). The assumed steady-state ground-water-levels and tunnel flow data was calibrated with an excellent match and other ground-water-levels for this situation seemed reasonable on a regional scale. Also, the numerical model does a reasonably good job at simulating the major ground-water-level trends observed in transient well data. Statistically, the model simulated observed high-level water-levels to within: 48 ft. based on the mean absolute error;. approximately 50 ft. based on the average mean error; and approximately 70 ft. based on the standard deviation. However, this error is relatively minor given the high water-levels for most wells on Lana'i.

The transient simulations reproduced observed transient water-levels reasonable well except for a few sites. However, the inability to utilize a single global storage coefficient testifies that localized water-level responses are difficult to match. Also, inaccurate transient responses in Shaft 3/Well 2 and Well 5 could be based on inaccurate boundary conditions and do not even consider the additional complications of including well inefficiencies. The issue is basically, one of precision vs. accuracy; the numerical modelling effort has scrutinized Lanai's ground-water flow system in high detail and precision but it is not necessarily accurate. The higher level of precision than previous studies gives one greater confidence in the recharge and conceptual make-up of the island, but the localized conditions are such that the assumptions of homogeneity and isotropy are limited to the regional scale of the island. Still, these simple island-wide assumptions and approach enabled the model to match the observed data reasonable well. The advantage of the regional assumptions is that it simplifies the model to a point where hydrologists can agree upon a simplified conceptual model, which can then be 'effectively' calibrated, and agree to disagree on how closely the numerical model represents the actual 'reality' at the localized scale. Ignoring this approach would open the model up to much more subjectivity and lead to a greater multitude of non-unique solutions which were initially sought to be constrained by the assumptions of homogeneity and isotropy.

It is believed by many prominent hydrologists that the true value of numerical models are the insights into how an aquifer flow system works (Anderson, 1994; Bredehoeft, 1994, 1995; Konikow, 1994). This study has provided a few from which several conclusions can be drawn.

Beginning with the source of ground-water, it is clear that the estimated ground-water recharge to the entire island is more than previously estimated. Both the GIS and the calibrated numerical model analysis in this study support this conclusion. The long-term average recharge estimate for Lana'i is approximately sixty (60) mgd which includes fog-drip, or whatever phenomena is augmenting rainfall precipitation, above the 2000' elevation.

The insight provided through sensitivity analysis clearly shows that under natural conditions both horizontal flow boundary and recharge magnitudes and their spatial distributions are the most important variables in controlling the ground-water flow system on Lana'i. This conclusion has various implications. One is that the combination of these two parameters *together* is the major controlling factor which governs the observed water-level responses to induced climactic and man-made stresses on the flow system rather than each of these parameters alone. This was clearly shown by the problem of Shaft 2 continually drying up until the GIS spatially distributed recharge was overlaid upon the internal system of horizontal flow boundaries. Likewise, it was difficult to match observed water-levels for Well 5 any better than 150 ft. error and would require changing assumptions of homogeneity in various parameter values or spatial placement of internal boundaries to reduce such error.

Since the calibrated model is sensitive to recharge then recharge should be protected and enhanced to guarantee a reliable ground-water resource. The numerical model has shown the importance of fog-drip and makes a strong case for the maintenance of fog-drip efficient vegetation above the 2000' elevation. A significant portion of drawdowns observed in the wells may be attributed to changes in the forest cover in the cloudy regions above 2000' ft. This has been suggested as early as 1974 (Bowles).

Given the insights provided by calibrating the model, additional insights are provided by imposing changes in stresses on the calibrated model. The spatial distribution and magnitude of pumpage are just as important as the recharge and internal boundary structures. The reader need only be reminded of the comparative results between predictive scenario 2 (fog-drip removal) & 3 (6 mgd pumping from existing sources) where drawdowns for the latter were greater than the former despite having approximately 30% less removal of water from the aquifer to see the truth in this conclusion.

Transient analysis has provided the insight that the time required to reach steady-state conditions is on the order of a few to several centuries. Also, in terms of steady-state water-levels only, the model indicates that if current conditions remain unchanged drawdowns are 20% to 95% complete although it may take many years to reach 100% average steady-state water-levels.Management decisions regardless of the model's validity, or 'closeness' in representing reality.

Predictive model runs provide additional insights. First, the model predicts that the reduction of forest cover would affect ground-water-levels drastically. The model shows that many more wells would be necessary to achieve pumpages near the current CWRM sustainable yield estimate of 6 mgd assuming that long-term recharge conditions in the regions above 2000' elevation remain stable. Also, modifications are probably necessary to existing well configuration to

realize greater long-term development of ground-water on Lana'i. It appears that more water could be developed from the windward side of the island. This is consistent with Adams's (1968) conclusions of developing sources along the northeastern windward shores of the island although better quality water in the high-level aquifer is likely more inland. However, the model cannot address the subject of individual well yields due to the uncertainties of localized heterogeneities and well inefficiencies. Other published numerical modelling studies in Hawaii (Underwood, & others, 1995) have stated such information must be gained through field experience or have limited their predictions in water-levels to areas rather than specific well sites (Eyre, & others, 1986).

Finally, there is general agreement between hydrologists that post-auditing is a necessary element of any worthwhile the modelling effort (Anderson, 1994; Bredehoeft, 1994, 1995; Konikow, 1994, Oreskes, & others, 1994). Post-auditing is the continued recalibration of the model with new information, thus continued data collection is absolutely necessary (Emery, 1994). Even with all the available data on Lana'i the continuation of long-term data collection is necessary if improvements to this model are desired. Areas of data collection which could be improved on Lana'i are pan evaporation and further fog-drip analysis. The continued monthly measurement and reporting of long-term well pumpages and pumping and non-pumping water-levels is also necessary to contribute to any post-auditing effort. Additionally, to address 3D concerns and geothermal impacts additional layers and variable density fluid changes could be made to the model.

With the current drilling of Well 14, the need of post-auditing is underscored. The initial ground-water-level encountered is unofficial but reportedly confined and artesian conditions have been observed. This confined situation is not considered in the current numerical model since it is only one layer. If true, this shows the need for post-auditing of model work to further fine tune this model or and any numerical model. The Lana'i numerical model is one step towards a finer tuned model but it is not the final model. Additional study could be performed to use multiple layers for a more fully three-dimensional ground-water flow model and perhaps even transport modelling of chlorides can be performed in the future to further fine-tune a tool with which to assess natural and hurnan induced stresses on Lanai's ground-water resource.

This report has also provided a general guideline in documenting numerical modelling efforts. There are guidelines available (Anderson & Woessner, 1992; ASTM, 1993, CWRM, 1994) but none has been officially approved or endorsed by the CWRM. Guidelines are necessary to convey the assumptions, analysis, and results in a simple and consistent format.

In closing, Loucks (1995) has defined numerical models useful for management decisions as Decision Support Systems (DSS). To be useful, numerical models need to be easy to learn and remember and useful in providing information in a meaningful form (i.e. graphically) and in a timely manner. The input and output methods used to design and calibrate the Lana'i model probably do not meet this criteria at this time, especially if post-auditing is undertaken. However, new software is emerging which expedites this process. Information and insights gathered from this modelling effort can no doubt be used when this newer user friendly software is available.

References Cited

Adams, W.M.; Huber, R.D., 1973, *Optimum Drilling Sites for Ground-Water Development on the East Coast of Lanai Island*, Technical Report no. 68, Water Resources Research Center, University of Hawaii, Honolulu, HI, 43 p.

American Society for Testing and Materials (ASTM), DRAFT January 6, 1993, *Standard Guide for Documenting a Groundwater Flow Model Application*, 9 p.

Anderson, K.E., April 1959, *Water Supply Analysis - Lanai*, consulting report to Hawaiian Pineapple Co., Ltd., Anderson & Kellty, Inc., Bosie, ID, 17 p.

Anderson, K.E., September 1959, *Water Supply Analysis - Lanai*, consulting report to Hawaiian Pineapple Co., Ltd., Anderson & Kellty, Inc., Bosie, ID, 3 p.

Anderson, K.E., October 5, 1959, *Letter to Wm. Aldrich, Plantation Manager Hawaiian Pineapple Co.*, 3 p.

Anderson, K.E., March 1960, *High-Level Water Resources Lanai, Hawaii*, consulting report to Hawaiian Pineapple Co., Ltd., Anderson & Kellty, Inc., Bosie, ID, 5 p.

Anderson, K.E., April 1961, *High-Level Water Resources Lanai, Hawaii*. consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 16 p.

Anderson, K.E., July 1961, *High-Level Water Resources Lanai, Hawaii*, consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 5 p.

Anderson, K.E., October 1961, *High-Level Water Resources Lanai, Hawaii*, consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie. ID, 21 p.

Anderson, K.E., April 1983, *Lanai Water-Supply Review*, annual consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 36 p.

Anderson, K.E., 1984, *Letter report to J.H. Parker*, letter consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 37 p.

Anderson, K.E., 1984, *Lanai Water-Supply Review*, annual consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 37 p.

Anderson, K.E., 1985, *Lanai Water-Supply Review*, annual consulting report to Dole Corp., Lanai Plantation, Anderson & Kellty, Inc., Bosie, ID, 42 p.

Anderson, K.E., 1989, *Lanai Water Supplies*, consulting memo to Robert Oda, Lanai Co., James M. Montgomery, Consulting Engineers, Inc., Bosie, ID, 2 p. (also located in appendix in M&E, 1989 reference).

Anderson, M.P.; Woessner, W.W., 1992, *Applied Groundwater Modeling*, Academic Press, Inc., Harcourt Brace Jovanovich, 381 p.

Anon, 1954, *Condensation from Clouds on Table Mountains*, South Africa Journal of Science, June, 303 p.

Appel, C.A and Reilly, T.E, 1994, *Survey of Selected Computer Program Produced by the U.S. Geological Survey for Simulation of Ground-Water Flow and Quality.* Circular 1104, U.S. Geological Survey, Department of the Interior, United States of America.

Armstrong, R.W. & others, 1973, Atlas of Hawaii, University of Hawaii, The University Press, Honolulu, HI, p. 43.

Bear, J.; Beljin M.S,; Ross, R.R., 1992, *Fundamentals of Ground-Water Modeling*, Environmental Protection Agency, Paper EPA/540/S-92/005, Ada, Oklahoma, 11 p.

Bowles, S.P., 1971, *Water Management Plan*, unpublished report for Lanai Co., Waimea, HI.

Bowles, S.P., 1974, *Water Resources of Lanai Summary*, 12/10/73 Draft report for Lanai Co., Waimea, HI, 20 p.

Bredehoeft, J.D., 1994, *Modeling Complex Hydrologic Systems for the Purpose of Management*, Keynote Address at the 1994 Pacific Northwest/Oceania Conference - Assessment of Models for Groundwater Resources Analysis and Management.

Bredehoeft, J.D., 1995, *Ground-Water Models*, Editorial in Ground Water, Vol. 33, No. 4, pgs. 530-531.

Carlson, N.K., 1961, *Fog and Lava Rock, Pine and Pineapples*, American Forests 67(2): pp. 8-11, 58-59.

Caskey, M.C.,1968, *The Recharge of the Waikapu Aquifer, Maui*, Master's Thesis in Hydrology, Water Resources Research Center, University of Hawaii, 73 p.

Chang, J.H., 1961, *Microclimate of Sugar Cane*, Hawaiian Planter's Record. 56: p. 195-223.

Chang, J.H., 1968, *Climate and Agriculture, an Ecological Survey*, Aldine Publishing Co., Chicago, 304 p.

Ching, A.Y.; Sahara, T., 1969, *Land Use and Productivity Rating, State of Hawaii, 1968*, Circular no. 15, Land Study Bureau, University of Hawaii, Honolulu, HI.

Clark, W.O., 1930, *Ground-Water of Lanai*, consulting report to Hawaiian Pineapple Co., Ltd., 5 p.

Coleman Energy & Environmental Systems - Blackhawk Geosciences Division (CEES-BGD), 1984, *Time Domain Electromagnetic Surveys for Assisting in Determining the Ground Water Resources Phase II Study Island of Lanai, Hawaii*, Prepared for Lanai Water Company Inc., Golden, CO., 21 p.

Commission on Water Resource Management, 1990, *Lanai Water Resources Findings of Fact*, WMA No. L-1, Department of Land and Natural Resources, State of Hawaii, Honolulu, HI, 139 p.

Commission on Water Resource Management, DRAFT 1994, *Ground Water Model Reports, A Guide for Documentation*, Department of Land and Natural Resources, State of Hawaii, Honolulu, HI, 2 p.

Data General Corp., 1990, *AViiON 300 Series Workstation*, Westboro, MA.

DuCommon, J., 1928, *On the Use of Fresh Water Springs, Fountains, etc.*, American Journal Science and Arts, vol. 14, pp. 174-176.

Driscoll, F. G., 1986, *Groundwater and Wells, Second Edition*, Johnston Filtration Systems, Inc., St. Paul, Minnesota, 1089 p.

Ekern, P.C., 1960, *The Evapotranspiration of Pineapple in Hawaii*, Pineapple Research Institute, Honolulu, Hawaii, 233 p. & 1965 PRI, Plant Physiol. 40(4), pp. 736-739.

Ekern, P.C., 1964, *Direct Interception of Cloud Water on Lanaihale, Hawaii*, Soil Science Society of America Proceedings, vol. 28, no. 3, pp. 419-421.

Ekern, P.C.; Chang, J-H, 1985, *Pan Evaporation: State of Hawaii, 1849-1983*, prepared in cooperation with Hawaiian Sugar Plantations Association, State of Hawaii, Department of Land and Natural Resources, Report R74, Honolulu, HI, 172 p.

El-Kadi, A.I.; Brusaert, W., 1985, *Applicability of Effective Parameters for Unsteady Flow in Nonuniform Aquifers*, Water Resources Research, vol. 21, no. 2, pp. 183-198.

Emery, P. A., 1994, *Reflections on Water of an Old Geologist, Hydrogeologist, or Geohydrologist*, The American Institute of Professional Geologists, The Professional Geologist, vol. 31, no. 8, pp.11-12.

Environmental Systems Research Institute (ESRI), 1992, *ARC-INFO Geographic Information System (GIS) Ver 6.0*, Redlands CA.

Essaid, H.I., 1990, *The computer model SHARP, a Quasi-Three-Dimensional Finite-Difference Model to SImulate Freshwater and Saltwater Flow in Layered Coastal Aquifer Systems*, WRI Rep 90-4130, U.S. Geological Survey, Department of the Interior, United States of America, 181 p.

Eyre, P.; Ewart, C.; Shade, P., 1986, *Hydrology of the Leeward Aquifers, Southeast Oahu, Hawaii*, WRI Rep 85-4270, U.S. Geological Survey, Department of the Interior, United States of America, 75 p.

Foote, D.E.; Hill, E.L.; Nakamura, S.; and Stephens, F.; 1972, *Soil Survey of Islands of Kauai, Oahu, Maui. Molokai, and Lanai, State of Hawaii*, Soil Conservation Service, Department of Agriculture, United States, prepared in cooperation with the University of Hawaii Agricultural Experiment Station, 232 p.

Fosberg, F. R., 1936, *Plant Collecting on Lanai*, Mid-Pacific Magazine 49(2): pp. 119-123.

Franke, O.L. and T.E. Reilly 1987, *The Effects of boundary Conditions on the Steady-State Response of Three Hypothetical Ground-Water Systems; Results and Implications of Numerical Experiments*, Water Supply Paper 2315, United States Geological Survey, Department of the Interior, Washington, D.C., 19 p.

Franke, O.L.; T.E. Reilly; and F.D. Bennet, 1984, *Definition of Boundary and Initial Conditions in the Analysis of Saturated Ground-water Flow Systems; an Introduction*, Open-File Report 84-458, United States Geological Survey, Department of the Interior, Washington, D.C., 26 p.

Gay, L.K.; 1965, *True Stories of the Island of Lanai*, Rodger's Printing Inc., Honolulu, HI, 85 p.

Geraghty & Miller, Inc., 1989, *AQTESOLVE Ver 1.1, Aquifer Test Design and Analysis Computer Software*, IBM-PC DOS Program, Reston, VA, Manual 135 p.

Ghyben, B., 1889, *Nota in verband mer de voorgenomen put boring nabij Amsterdam*: K. inst. ing. Tijdschr.,The Hague, 21 p.

Giambelluca, T.W., 1983, *Water Balance of the Pearl Harbor Basin, Hawai'i, 1946-1975*, Technical Report No. 151, Water Resources Research Center, University of Hawaii, 151 p.

Giambelluca, T.W., 1986, *Land-use Effects on the Water Balance of a Tropical Island*, National Geographic Research 2(2), pp. 125-151.

Giambelluca, T.W.; Nullet, M.A., Schroeder; T.A, 1986, *Rainfall Atlas of Hawaii*, prepared in cooperation with the Water Resources Research Center and the Department of Meteorology at the University of Hawaii, State of Hawaii, Department of Land and Natural Resources, Report R76, Honolulu, HI, 267 p.

Giambelluca, T.W.; Nullet, M.A.; Ridgley, M.A.; Eyre, P.R., Moncur, J.E.T.; Price, S., 1991, *Drought in Hawai'i*, State of Hawaii, Department of Land and Natural Resources, Report R88, Honolulu, HI, 232 p.

Harding Lawson Associates, 1986, *Electrical Resistivity Investigation for Ground-Water Resources Lanai City Area, Island of Lanai, Hawaii*, consulting report to Dole Co., Castle & Cooke Foods, Novato, CA, 21 p.

Hawaii Water Authority, 1959, *Water Resources in Hawaii*, Territory of Hawaii, 148 p.

Heath, R.C., 1982, *Basic Ground-Water Hydrology*, Water Supply Paper 2220, Department of the Interior, USGS, Prepared in cooperation with the North Carolina Department of Natural Resources and Community Development, Denver, CO, 84 p.

Herzberg, B., 1901, *Die Wasserversrgung einiger Nordseebader*: Journal Gasbeleuchtung und Wasserversrorgung, Jahrg 44, Munich.

Hobdy, R., 1993, *Lana'i - A Case Study: The Loss of Biodiversity on a Small Hawaiian Island*, University of Hawaii Press, Pacific Science vol. 47, no. 3, pp. 201-210.

Hsieh, P.A.; Freckleton, J.R., 1993, *Documentation of a Computer Program to Simulate Horizontal-Flow Barriers Using the U.S. Geological Survey's Modular Three-Dimensional Finite Difference Ground-Water Flow Model*, Open-File Report 92-477, U.S. Geological Survey prepared in cooperation with the City of Santa Barbara, Sacramento, CA, 32 p.

Hydrosphere, Inc., 1992, *National Climatic Data Center, Hourly Precipitation*, CD-ROM Vol 3.0, Boulder, Colorado.

Jones, C.A., 1980, *A Review of Evapotranspiration Studies in Irrigated Sugarcane in Hawaii*, Hawaii Sugar Plantation Association, Hawaii Planters Record vol. 59, no. 9, pp. 195-214.

JMM Consulting Engineers, Inc. 1989, *Lanai Water Use (1948-1988)*, Boise, Idaho, 10 p.

Juvik, J.O.; Ekern, P.C., 1978, *A Climatological of Mountain Fog on Mauna Loa, Hawaii Island*, Technical Report No. 118, Water Resources Research Center, University of Hawaii, Honolulu, HI, 62 p.

Kerfoot, O., 1962, *The interception and Condensation of Atmospheric Moisture by Forest Canopies*, East African Agriculture and Forestry Research Organization, Maguga, Kenya, 7 p.

Konikow, L.F., 1994, *The Value of Postaudits in Ground-Water Model Applications*, oral presentation of paper at the 1994 Pacific Northwest/Oceania Conference - Assessment of Models for Groundwater Resources Analysis and Management.

Krivoy, H.C.; Lane, M.P., 1965, *A Preliminary Gravity Survey of the Island of Lanai, Hawaii*, Pacific Science, vol. 19, no. 3, pp. 346-348.

Lloyd, R.H., 1975, *Lanai Water Development, Unusual Wells and Tunnels*, Lanai Co. Report, 17p.

Lohman, S.W., 1979, *Ground-Water Hydraulics*, Professional Paper 708, Geological Survey, Department of the Interior, United States, Washington, 70 p.

Loucks, D.P., 1995, *Developing and Implementing Decision Support Systems: A Critique and a Challenge*, Water Resources Bulletin, Vol. 31, No. 4, American Water Resources Association, pp. 571-582.

M & E Pacific, Inc., 1989, *Water Resources Development Plan for the Island of Lanai, Lanai, Hawaii*, consulting report to Lanai Co., Honolulu, HI, 18 p.

M & E Pacific, Inc. 1991, *Preliminary Engineering Report for New Potable Water Source, Well 8, Lanai Water System, Lanai City, Hawaii*, consulting report to Lanai Co., HI, 35 p.

Malahoff, A.; Wollard, G.P. 1965, *Magnetic Surveys over the Hawaiian Ridge*, Report HIG-65-11, Hawaii Institute of Geophysics, University of Hawaii, 64 p.

Macdonald, G.A., 1940, *The Petrography of Lanai and Kahoolawe*, Part 1, Bulletin 6, Division of Hydrography, Territory of Hawaii in cooperation with the U.S. Geological Survey, Department of the Interior, United States of America, pp. 61-63.

Macdonald, G.A., 1956, *The Structure of Hawaiian Volcanoes*, Koninklijk Nederlandsch Geologisch-Mijnbouwkundig Genootschap, Verhandelingen, v. 16, pp.274-295.

Macdonald, G.A., Abbott, A.T., 1970, *Volcanoes in the Sea*, University of Hawaii Press, Honolulu, Hawaii, 429 p.

Marloth, 1905, Trans. S. Africa Phil. Soc., 14 Part 2, p. 97.

Malo, D., 1898, *Hawaiian Antiquities (Moolelo Hawaii) 1839*, translated by Dr. Nathaniel Emerson in 1898, Bernice Bishop Museum, special publication 2, Honolulu, HI 278 pp.

McCullough, Albert, P.E. 4/22/95 personal communication during field visit to Shaft 1 and Shaft 2.

McDonald, M. and Harbaugh, A., 1988, *A Modular Three-Dimensional Finite Difference Ground-Water Flow Model*, MODFLOW Fortran Program Manual, Book 6, Chapter A1, Modeling Techniques, United States Geological Survey, Department of the Interior, Washington, D.C., 512 p.

McKnight, J.H.; Juvik, J.O., 1975, *Methodological Approaches in Hawaiian Fog Research*, Tech. Report no. 85, Water Resources Research Center, University of Hawaii, Honolulu, HI, 34 p.

Merriam, R.A, 1960, *A Note on the Interception Loss Equation*, Journal of Geophysical Research 65 (11), pp. 3850-3851.

Merriam, R.A, 1961, *Surface Water Storage on Annual Rye Grass*, Journal of Geophysical Research 66 (6), pp. 1833-1838.

Merriam, R.A, 1973, *Fog Drip from Artificial Leaves in a Fog-Wind Tunnel*, Water Resources Research. Vol 9., no. 6, pp. 1591-1598.

Meyer, W. and Souza, W.R., 1995, *Factors that Control the Amount of Water that can be Diverted to Wells in a High-Level Aquifer*, Proceedings of the American Water Resources Association Annual Summer Symposium, edited by Herrmann, R.; Back, W.; Sidle, R.C.; and Johnson, A.I., AWRA, Herdon, VA, pp. 207-216.

Mink, J.F., 1983, *Lanai Water Supply*, consulting report to Lanai Co., Honolulu, HI, 57 p.

Mink, J.F., Lau, L.S. 1993, *Aquifer Identification and Classification for Lana'i: Groundwater Protection Strategy for Hawaii*, Technical Report No. 190, Water Resource Research Center, University of Hawaii, State of Hawaii, 20 p.

Molchanov, A. A., 1960, *The Hydrological Role of Forests*, U.S. Department of Agriculture and National Science Foundation, Washington, D.C, translated from Russian by Gourevitch, A. Israel Program fro Scientific Translations, Jerusalem., 407 p.

Montgomery, J.M. (JMM, Inc.), 1989, *Lanai Water Use, (1948-1988)*, consulting report to Lanai Co., 10 p.

Moore, J.G.; Clague, D.A.; Holcomb. T.Y.; Lipman, P.w.; Normark, W.R.; and Torresan, M.E., 1989, *Prodigious Submarine Landslides on the Hawaiian Ridge*, Journal of Geophysical Research, Vol. 94, No. B12, pp. 17465 - 17484.

Munro, G. C. 1922, *Letter to the Editor*, Hawaiian Forester and Agriculturist 19(2), pp. 45-46.

Munro, G. C. 1929, *Norfolk-Island-Pine for the Wet Forest*, Hawaiian Forester and Agriculturist 26(3), pp. 126-127.

Oreskes, N.; Shrader-Frecchette, K.; Belitz, K., 1994, *Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences*, Science, vol. 263, pp. 641-646.

Palmer, H.S., 1924, *Groundwater Conditions on the Island of Lanai*, University of Hawaii, Honolulu, HI

Penman, H.L., 1948, *Natural Evaporation from Open Water, Bare Soil, and Grass*, Proceedings, Royal Society, Series A, 193: pp. 120-145.

Penman, H.L., 1963, *Vegetation and Hydrology*, Commonwealth Bureau of Soils Technical Communication, no. 53, Commonwealth Agricultural Bureau, Farnham Royal, Bucks, England, 124 p.

Prime Computer, Inc. *PRIME 9955 Mini-computer*, Prime Park, Natick, MA.

Roberson, J.A.; Crowe, C.T., 1980, *Engineering of Fluid Mechanics, Second Edition*, Washington State University, Pullman, WA, 661 p.

Sahara, S.T.; Murabayashi; E.T., Ching, A.Y.; Kuwahara, I.; Fujimura, F.N.; Awai, E.L.; Baker, H.L., 1967, *Detailed Land Classification - Island of Lanai*, Bulletin no. 8, Land Study Bureau, University of Hawaii, Honolulu, HI, 54 p.

Schroeder, T.A., Meisner, B.N., 1982, *Median Rainfall, State of Hawaii*, Circular C88, State of Hawaii, Department of Land and Natural Resources, Honolulu, HI, 44 p.

Shade, P.J., 1995, *Water Budget for the Island of Kauai, Hawaii*, Water Resources Investigations Report 95-4128, U.S. Geological Survey, 25 p.

Shuttleworth, J.W., 1993, *Chapter 4, Evaporation*, Handbook of Hydrology (editor-in-chief: Maidment, D.R.), McGraw-Hill, Inc., USA, pp. 4.1 to 4.53.

Smith, C., Soil Conservation Scientists, 10/20/94, written & faxed personal communication to Pat Shade on soil on various characteristics for Lanai, Soil Conservation Service, U.S. Department of Agriculture, United States of America.

Smith, L. & Wheatcraft, S.W, 1993, *Chapter 6, Groundwater Flow*, Handbook of Hydrology (editor-in-chief: Maidment, D.R.), McGraw-Hill, Inc., USA, pp. 6.1 to 6.58.

Soroos, R.L., 1973, *Determination of Hydraulic Conductivity of Some Oahu Aquifers with Step-Drawdown Test Data*, Thesis for M.S. in Geology and Geophysics, University of Hawaii, Honolulu, HI, 239 p.

Souza, W, Voss, C., 1987, *Analysis of an Anisotropic Coastal Aquifer System Using Variable-Density Flow and Solute Transport Simulation*, Journal of Hydrology, Vol. 92, pp. 17-41.

Stearns, H.T., 1938, *Ancient Shore Lines on the Island of Lanai, Hawaii*, Geologic Society of America, Bulletin vol. 49, pp. 615-628.

Stearns, H.T; Macdonald, G.A.; Swartz, J.H., 1940, *Geology and Ground-Water Resources of Lanai and Kahoolawe, Hawaii*, Part 1, Bulletin 6, Division of Hydrography, Territory of Hawaii in cooperation with the U.S. Geological Survey, Department of the Interior, United States of America, 115 p.

Stearns, H.T; Macdonald, G.A.; Swartz, J.H., 1942 *Geology and Ground-Water Resources of the Island of Maui, Hawaii*, Bulletin 7, Division of Hydrography, Territory of Hawaii in cooperation with the U.S. Geological Survey, Department of the Interior, United States of America, 344 p.

Stearns, H.T., 1946 with supplement 1967, *Geology of the Hawaiian Islands*, Bulletin 8, Territory of Hawaii in cooperation with the U.S. Geological Survey, Honolulu, HI, 112 p.

Stearns, H.T., 1953, *Supplement Ground-Water Development on Lanai*, consultant report to Lanai Co. concerning proposed Shaft 3, 7 p.

Stearns, H.T., 1959, *Methods for Developing Additional Water on Lanai, Hawaii*, consultant report to Hawaiian Pineapple Co., 3 p.

State of Hawaii, 1972, *Soil Survey Interpretations Lanai*, Report R44, Division of Water and Land Development, Department of Land and Natural Resources, State of Hawaii, 36 p.

State of Hawaii, 1973, Climatological Stations in Hawaii, Report R42, Division of Water and Land Development, Department of Land and Natural Resources, State of Hawaii, 187 p.

State of Hawaii (draft), 1992, *Water Resources Protection Plan, Hawaii Water Plan*, Commission on Water Resource Management, Department of Land and Natural Resources, State of Hawaii, 555 p.

Swartz, J.H., 1940, *Geophysical Investigation on Lanai*, Part 1, Bulletin 6, Division of Hydrography, Territory of Hawaii in cooperation with the U.S. Geological Survey, Department of the Interior, United States of America, pp. 97-115.

Takasaki, K.J.; Mink, J.F., 1982, *Water Resources of Southeastern Oahu, Hawaii*, Water-Resources Investigations 82-628, prepared in cooperation with the Honolulu Board of Water Supply, U.S. Geological Survey, Department of the Interior, United States of America, 89 p.

Takasaki, K.J.; Mink, J.F., 1985, *Evaluation of Major Dike-Impounded Ground-Water Reservoirs, Island of Oahu*, Water-Supply Paper 2217, U.S. Geological Survey, Department of the Interior, United States of America, 77 p.

Takasaki, K.J.; Bauer, G., 11/9/93 field verification of well and ground-water elevations.

Theis, C.V., edited by Clebsch, A., 1994, *Selected Contributions to Ground-Water Hydrology by C.V. Theis, and a Review of His Life and Work*, Water-Supply Paper 2415, U.S. Geological Survey, Department of the Interior, United States of America, 70 p.

Theis, C.V., 1957, *The Source of Water Derived From Wells, Essential Factors Controlling the Response of an Aquifer to Development*, Ground Water Notes, Hydraulics, no. 34, Water Resources Division, U.S. Geological Survey, Department of the Interior, United States of America, 16 p.

Thornthwaite, C.W., Mather, J.R., 1955, *The Water Balance*, Publications in Climatology, vol. 8, no. 1, 104 p.

Todd, D.K., 1980, *Groundwater Hydrology, 2nd Edition*, University of California, Berkley and David Keith Todd Consulting Engineers, Inc., John Wiley & Sons, 535 p.

Twomey, S. 1957, *Precipitation by Direct Interception of Cloud-Water*, Division of Radiophysics, Commonwealth Scientific and Industrial Research Organization, Australia, reprinted from Weather, vol. XII, no. 4 pp. 120-22.

Underwood, M.R.; Meyer, W.; Souza, W.R, *Ground-Water Availability from the Hawi Aquifer in the Kohala Area, Hawaii*, Water Resources Investigations Report 95-4113, U.S. Geological Survey, 57 p.

United States Geological Survey, 1972, *Ground-Water Hydraulics*, Professional Paper 708, Department of the Interior, Washington, D.C., 70 p.

U.S. Water Resources Council & State of Hawaii, 1979, *Hawaii Water Resources Plan*, Regional Water Resources Study, Honolulu, HI, 207 p.

Walker, G.P.L., 1987, *The Dike Complex of Koolau Volcano, Oahu: Internal Structure of a Hawaiian Rift Zone*, Chapter 41, U.S. Geological Survey Professional Paper 1350, pp. 961-993.

Weeks, E.P. (instructor), 1994, *Analytical Methods to Determine Aquifer Properties and to Predict Aquifer Responses*, Course Instruction, Water Resource Division, U.S. Geological Survey, Department of the Interior, USA Feb 14-18, 1994.

Went, F.W., 1955, *Fog, Mist, Dew, and other Sources of Water*, Water, the Yearbook of Agriculture 1955, Washington, D.C., pp. 103-109.

Wentworth, C.K., 1925, *The Geology of Lanai*, Bulletin No. 24, Bishop Museum, Honolulu, HI.

Yuen, George A.L. & Associates, 1994, *Groundwater Development Opportunities, Laie Region, Koolauloa Aquifer System, Oahu*, prepared for the Honolulu Board of Water Supply, City and County of Honolulu, 39 p.

Appendices

Appendix A: Rainfall, Pan Evaporation, & Fog-Drip Data

Appendix B: GIS Monthly Recharge Results

Appendix C: Best Fit Calibration MODFLOW input files

Appendix D: Best Fit Output File from Appendix C input

Appendix E: Transient Stress Period Recharge Calculations

Appendix F: Individual Well Simulated vs. Actual Transient Water-Levels

Appendix G: Individual Well Long-Term Simulated Transient Water-Levels

Appendix H: Individual Well Monthly Water-Levels

APPENDIX A

LANAI CITY RAIN GAGE (SKN 672.00)

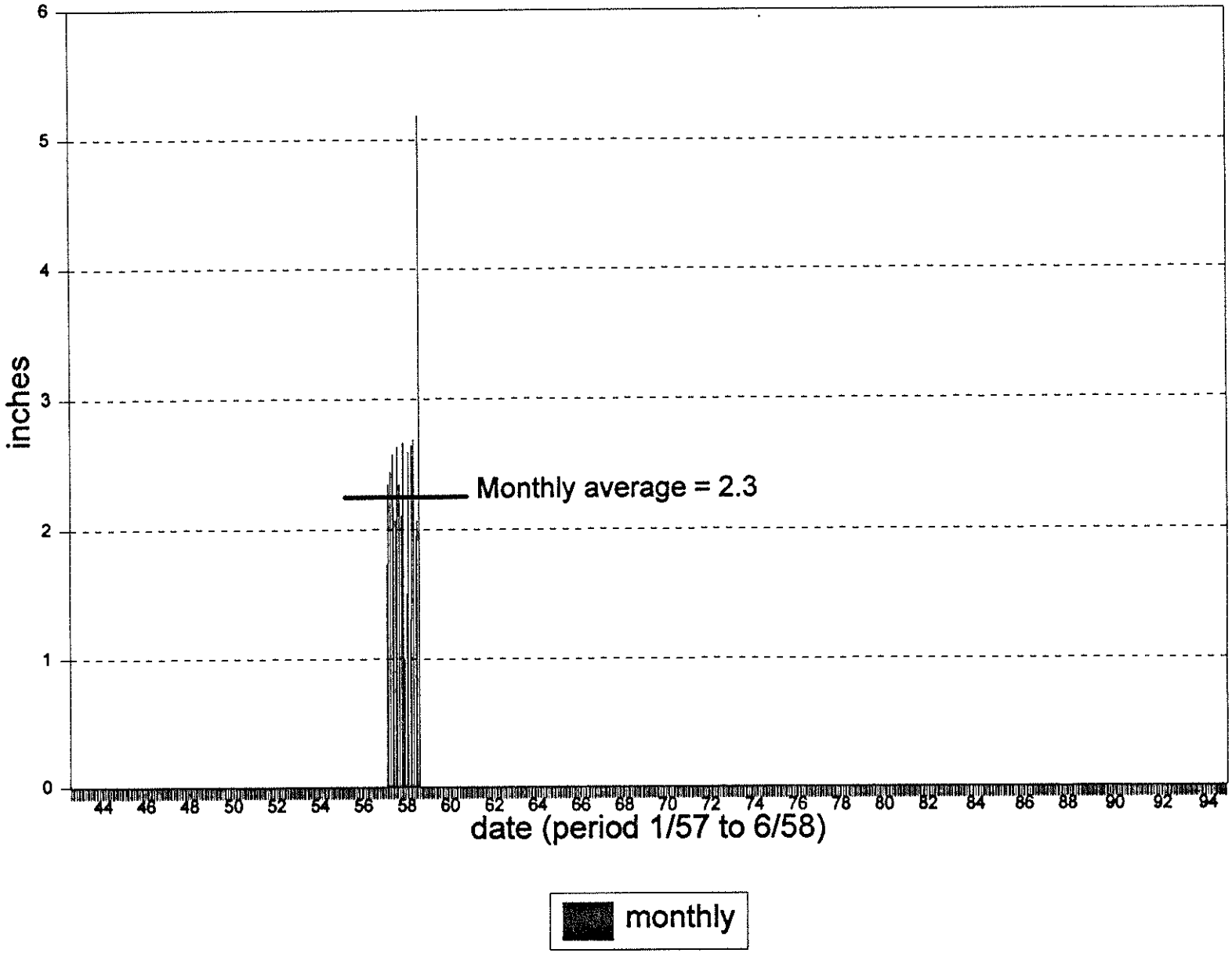
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1930	7.64	1.59	4.58	0.04	0.04	0.13	1.61	2.70	6.27	5.13	4.83	0.44	35.00
1931	0.47	0.36	3.25	2.98	3.92	0.71	2.85	4.45	4.49	4.22	0.84	1.46	30.00
1932	1.63	11.91	2.50	1.71	0.50	2.23	1.03	1.14	3.24	1.02	1.20	5.36	33.47
1933	0.50	6.26	3.21	1.15	0.32	0.60	0.54	1.05	0.08	0.60	1.09	7.39	22.79
1934	2.98	4.87	1.95	2.34	3.18	3.07	0.75	2.90	6.49	3.26	2.17	1.51	35.47
1935	4.42	0.92	5.63	0.30	1.56	2.02	1.34	2.69	3.90	6.25	2.01	0.61	31.65
1936	2.85	3.44	2.31	4.53	0.99	1.25	0.59	0.38	2.19	9.73	3.11	1.20	32.57
1937	7.08	10.97	13.63	1.37	3.26	0.60	1.64	2.15	1.00	3.52	1.32	5.96	52.50
1938	2.12	5.81	4.92	5.23	5.70	0.65	1.71	3.50	0.32	3.38	0.35	2.09	35.78
1939	2.68	2.39	5.36	7.87	1.68	1.88	0.20	1.13	3.42	7.03	1.56	3.01	38.21
1940	8.35	1.96	3.79	2.92	6.80	2.56	2.32	1.52	4.34	7.00	7.80	4.92	54.28
1941	1.63	1.42	0.69	0.61	1.92	0.41	1.29	2.22	0.77	5.44	0.84	0.31	17.55
1942	0.67	1.95	4.85	1.61	1.01	2.86	5.59	4.05	1.41	3.37	2.90	5.40	35.67
1943	17.42	2.26	2.31	1.63	10.90	0.69	0.92	1.42	0.72	2.76	0.10	2.94	44.07
1944	0.33	5.42	12.34	0.71	0.75	2.74	0.73	0.20	0.45	1.59	1.47	1.84	28.57
1945	0.44	1.76	2.65	19.18	2.03	0.78	4.24	0.98	0.89	0.87	1.38	3.06	38.26
1946	10.93	1.95	0.07	0.43	1.05	0.72	2.24	1.54	1.48	3.89	3.47	7.86	35.63
1947	0.65	2.11	3.56	1.58	2.09	0.34	3.35	1.23	7.74	0.60	3.71	1.73	28.69
1948	6.30	8.89	2.39	4.85	1.80	5.91	2.71	2.69	3.38	0.07	2.48	0.40	41.87
1949	11.61	3.09	0.83	0.78	0.76	2.20	1.03	0.55	0.16	0.17	1.51	1.46	24.15
1950	10.46	1.17	0.54	12.45	1.31	0.91	0.60	2.53	1.35	0.36	11.48	7.94	51.10
1951	1.44	7.45	21.59	2.03	1.99	0.98	0.98	2.10	1.38	4.49	0.82	3.24	48.49
1952	7.16	0.66	2.34	0.09	1.77	0.85	1.95	0.35	0.68	4.15	1.86	1.69	23.55
1953	1.47	1.36	3.00	0.90	2.90	0.52	0.52	0.26	0.07	0.87	0.73	3.44	16.04
1954	0.90	5.56	4.94	1.86	1.24	1.81	2.54	1.15	0.11	2.09	3.30	6.79	32.29
1955	4.69	5.69	3.87	1.09	0.95	0.51	1.24	2.31	5.69	0.48	13.33	12.33	52.18
1956	8.59	3.34	0.77	3.04	1.41	0.64	4.07	2.55	3.94	3.14	2.58	3.78	37.85
1957	6.60	1.75	0.73	2.48	4.11	0.19	0.66	2.24	0.97	0.47	7.43	4.17	31.80
1958	0.49	2.01	10.90	0.50	1.69	1.18	2.38	2.45	1.94	4.74	0.34	4.82	33.44
1959	12.75	3.99	0.31	0.96	1.49	0.35	0.49	0.43	3.26	0.88	4.11	0.86	29.88
1960	0.87	0.99	4.61	0.39	10.87	2.36	1.16	1.41	2.15	2.17	0.71	3.87	31.56
1961	6.36	2.00	0.64	2.61	1.29	1.57	1.52	0.99	1.74	7.04	10.41	1.29	37.46
1962	7.69	4.11	12.77	2.84	5.12	0.19	0.74	1.00	0.41	1.84	0.20	3.96	40.87
1963	16.75	1.95	10.04	7.52	10.07	1.61	2.43	2.00	1.39	3.85	0.94	4.31	62.86
1964	1.88	0.56	5.41	1.35	0.76	0.44	3.77	1.24	1.11	1.56	4.62	8.17	30.87
1965	5.71	5.44	1.53	5.09	7.04	0.85	2.58	3.63	5.21	5.62	16.53	1.11	60.34
1966	2.00	4.83	2.57	1.59	3.29	0.29	0.58	0.80	3.06	2.39	6.88	3.86	32.14
1967	7.94	2.98	10.09	4.41	8.74	2.36	7.45	2.72	4.05	1.96	4.31	9.46	66.47
1968	7.29	8.34	5.62	13.01	2.22	0.93	1.45	1.63	8.85	4.48	4.38	8.67	66.87
1969	11.16	1.91	3.34	0.93	2.01	1.67	3.20	0.53	1.96	1.33	0.52	4.73	33.29
1970	6.06	1.52	0.16	2.11	0.69	1.47	1.84	2.09	0.37	1.78	10.73	0.33	29.15
1971	16.90	1.50	4.30	0.82	2.51	0.13	0.39	0.79	1.50	1.28	0.42	1.40	31.94
1972	4.93	9.68	5.40	1.84	0.73	1.36	0.24	0.62	1.29	2.12	0.30	3.21	31.72
1973	1.43	0.87	0.67	1.34	2.44	0.42	0.22	2.32	1.44	1.23	8.59	6.90	27.87
1974	11.28	2.87	5.00	1.65	2.26	6.44	3.60	0.23	8.71	3.82	2.35	0.94	49.15
1975	10.52	6.21	1.87	2.19	0.37	0.44	1.47	0.17	0.97	0.34	2.11	1.09	27.75
1976	1.06	5.08	6.85	1.82	0.30	0.48	3.42	0.63	1.85	2.08	1.63	0.19	25.39
1977	1.43	0.76	2.70	11.51	3.38	0.39	0.66	0.95	0.28	1.37	0.71	1.16	25.30
1978	1.75	0.70	3.38	2.41	4.83	2.33	0.58	4.15	0.33	6.62	4.08	1.65	32.81
1979	7.86	13.66	1.40	2.30	1.28	0.40	0.92	2.64	0.57	2.33	0.58	7.21	41.15
1980	14.35	6.49	2.09	2.15	4.83	0.50	4.44	1.63	1.94	0.07	0.16	7.66	46.31
1981	1.15	2.34	0.55	4.30	2.64	0.69	1.10	3.51	1.10	0.60	2.87	9.70	30.55
1982	13.70	6.39	4.86	4.84	1.21	4.58	1.58	2.20	0.24	6.90	2.00	8.92	57.42
1983	1.18	0.95	0.42	0.61	2.15	1.34	0.81	1.62	1.11	1.27	0.97	7.53	19.96
1984	2.62	0.95	1.85	1.57	1.60	0.13	1.45	1.07	0.96	0.25	2.05	2.56	17.06
1985	4.60	2.94	0.67	0.27	1.03	2.30	1.17	0.99	4.10	5.64	6.10	1.20	31.01
1986	0.67	4.45	5.22	1.56	2.40	1.65	4.66	0.58	2.63	2.02	1.99	3.44	31.27
1987	1.57	2.99	1.26	2.56	8.26	0.70	3.36	1.05	4.07	0.79	5.28	10.40	42.29
1988	8.24	1.01	2.86	0.49	0.49	1.17	0.44	1.78	2.32	2.07	5.42	7.94	34.23
1989	0.43	6.90	3.95	14.31	1.98	3.57	2.27	1.16	0.41	11.44	1.49	4.22	52.13
1990	4.76	12.19	4.35	4.59	2.30	0.05	1.01	0.32	0.94	0.55	6.49	6.43	43.98
1991	3.65	-9.99	-9.99	0.00	4.30	0.29	1.02	0.99	0.00	6.69	0.38	2.74	20.06
1992	2.37	2.43	0.75	0.35	3.04	1.98	2.35	0.86	4.98	1.93	4.12	6.69	31.85
1993	4.43	1.42	2.55	0.83	2.02	1.42	1.75	1.36	4.63	3.53	5.25	0.06	29.25

KOELE RAIN GAGE (SKN 693.00)

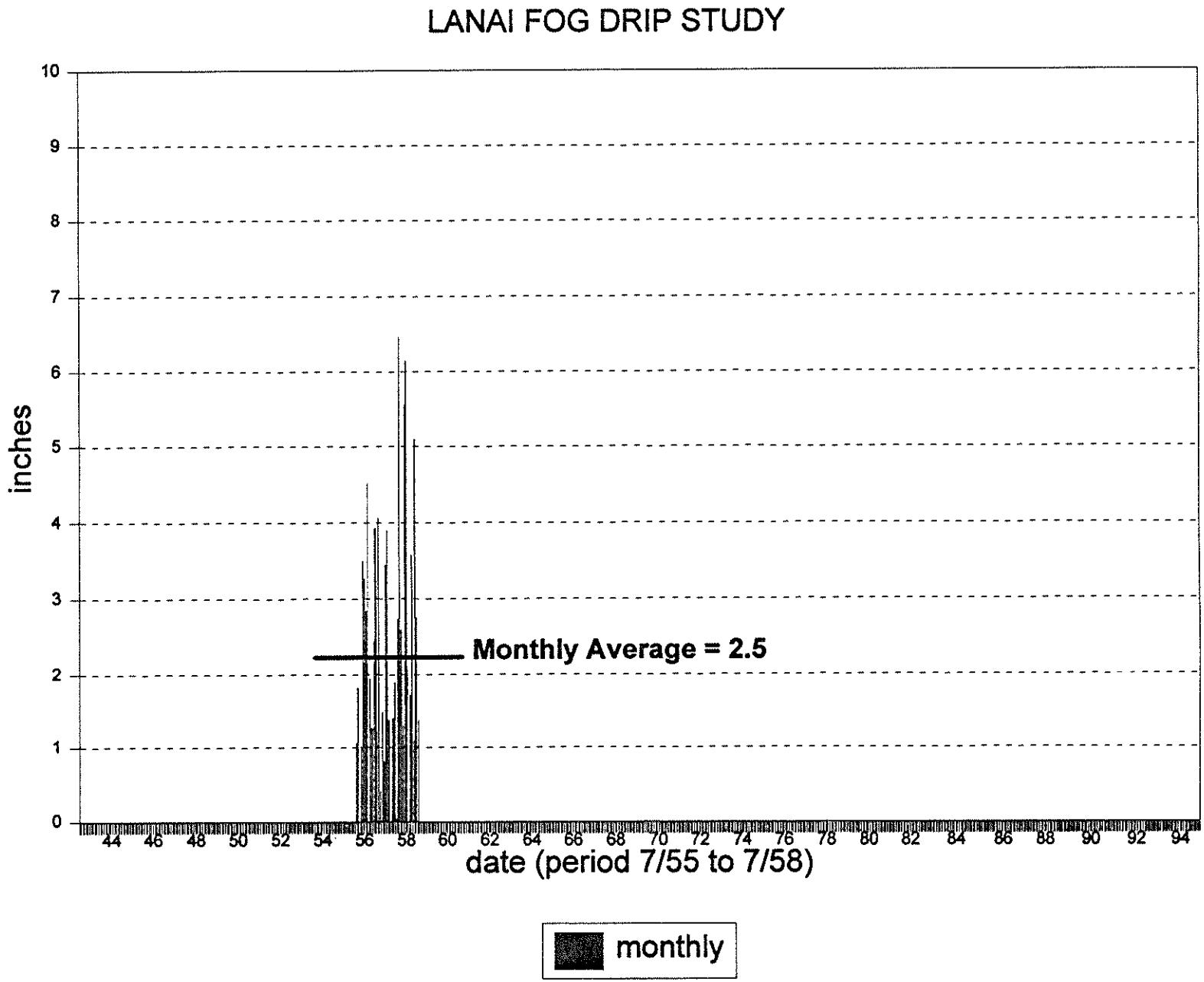
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1892	6.60	2.30	1.50	4.62	6.72	2.76	0.12	1.02	0.00	3.79	2.41	3.51	0.00
1893	1.35	12.81	1.79	1.57	0.86	1.46	0.45	3.22	0.18	2.09	6.85	2.58	35.21
1894	2.21	6.88	1.09	3.07	0.81	1.34	1.17	2.25	1.89	1.28	3.58	3.57	29.14
1895	6.86	2.56	1.41	0.56	1.59	0.65	2.79	6.10	3.39	1.88	1.93	5.85	35.57
1896	3.53	2.34	4.73	0.76	0.00	0.00	3.07	3.45	1.63	0.61	3.14	6.85	30.11
1897	1.89	0.83	1.75	0.93	3.01	2.56	0.71	1.49	5.87	4.96	2.81	3.65	30.46
1898	0.23	7.92	9.22	0.39	0.32	5.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1905	0.00	0.00	2.00	2.05	2.20	0.60	1.30	0.00	0.00	0.00	0.51	8.50	0.00
1906	4.75	0.60	1.99	2.83	0.50	0.05	0.00	0.11	1.16	0.00	3.50	8.60	0.00
1911	0.00	0.00	0.00	0.00	0.00	0.88	1.43	0.99	3.61	1.22	0.41	1.32	0.00
1912	0.78	3.09	1.24	2.68	0.45	1.15	1.84	1.03	0.74	0.81	0.39	0.64	14.84
1913	0.88	1.72	5.34	0.16	6.98	2.45	0.42	4.11	0.61	4.34	2.03	2.39	31.43
1914	5.17	3.36	7.92	4.16	5.94	1.04	1.85	4.32	5.40	0.74	0.00	6.80	46.70
1915	0.54	1.54	3.60	3.11	3.07	5.06	1.23	0.70	2.23	1.61	4.95	7.42	35.06
1916	22.28	2.81	5.70	3.61	4.62	0.43	1.82	0.81	0.65	3.04	2.47	4.04	52.28
1917	6.31	2.42	2.83	7.97	6.99	1.36	1.88	2.30	4.62	4.13	2.76	4.13	47.70
1918	4.77	5.96	5.41	10.80	1.83	1.41	0.68	2.74	1.40	0.43	4.03	1.84	41.30
1919	0.34	0.20	3.00	2.54	3.47	3.57	0.75	1.33	0.99	1.50	2.75	1.76	22.20
1920	6.32	0.68	0.89	2.32	2.43	0.92	1.88	1.43	0.67	2.94	0.94	9.94	31.36
1921	5.78	1.91	1.57	2.60	4.65	0.78	1.10	0.63	1.81	4.20	3.86	7.49	36.38
1922	1.88	2.00	2.02	1.66	0.49	1.61	1.69	3.08	3.75	5.14	1.69	0.21	25.22
1923	11.02	5.34	4.69	9.41	0.99	2.89	1.36	1.62	1.99	0.95	0.99	6.65	47.90
1924	0.90	1.75	2.47	8.20	4.55		1.93	0.44	1.65	2.33	1.16	9.75	0.00
1925	2.35	2.28	2.15	1.75	0.45	0.68	3.16	0.80	1.33	4.45	0.75	8.21	28.36
1926	2.50	1.11	2.81	1.53	1.24	6.30	2.69	3.85	4.44	4.99	0.79	0.88	33.13
1927	5.19	4.53	4.09	13.79	4.75	2.41	0.19	1.10	2.30	0.75	2.03	14.79	55.92
1928	1.13	2.50	1.51	3.48	1.87	0.48	1.20	0.72	1.41	1.47	0.99	0.25	17.01
1929	6.23	4.87	2.74	2.37	1.83	0.06	1.34	2.15	2.08	3.43	10.80	7.97	45.87
1930	7.72	1.39	3.88	0.81	0.48	0.30	1.34	2.20	4.87	5.12	4.28	0.70	33.09
1931	0.51	0.25	3.06	2.92	4.04	0.95	0.99	4.16	4.93	4.57	1.58	1.12	29.08
1932	1.48	11.82	2.60	1.12	0.21	1.91	0.98	0.76	3.13	0.73	1.14	4.54	30.42
1933	1.25	7.40	3.15	1.30	0.79	0.87	0.45	1.10	0.28	0.25	1.26	7.83	25.93
1934	2.75	4.77	1.98	2.36	2.47	2.58	0.48	4.72	5.42	3.75	2.20	1.80	35.28
1935	4.24	1.15	7.60	0.22	2.15	2.01	1.08	3.79	4.82	5.06	3.62	0.76	36.50
1936	2.56	4.88	3.20	6.42	1.25	1.70	0.72	0.45	3.97	10.15	3.08	0.55	38.93
1937	6.77	11.42	13.85	1.02	2.97	0.45	1.50	2.39	0.77	4.98	0.17	6.18	52.47
1938	2.08	6.03	6.19	6.01	7.63	1.44	0.98	4.05	0.27	2.87	0.27	1.73	39.55
1939	4.13	2.01	5.48	7.37	1.58	1.69	0.20	0.98	2.14	8.59	1.28	3.21	38.66
1940	8.08	2.10	4.12	2.39	7.08	1.49	0.72	0.91	4.45	7.81	7.84	6.61	53.60
1941	1.66	1.50	0.85	0.65	2.17	0.41	1.12	1.17	0.60	7.22	1.20	0.40	18.95
1942	0.81	1.77	4.08	1.34	1.49	1.96	5.43	3.40	1.90	3.57	2.74	5.98	34.47
1943	18.37	2.66	2.43	1.96	10.82	0.92	0.99	1.13	0.76	3.86	0.11	2.91	46.92
1944	0.21	4.72	13.50	0.73	0.81	2.21	0.65	0.20	0.57	1.87	1.10	2.05	28.62
1945	0.27	0.92	1.42	20.00	1.93	0.43	2.76	0.43	1.08	1.08	1.69	4.92	36.93
1946	14.59	1.38	0.00	0.50	0.76	0.75	2.35	1.51	1.12	3.58	3.39	7.40	37.33
1947	1.25	1.90	4.43	1.37	2.08	0.24	1.02	2.64	4.77	0.74	2.96	1.17	24.57
1948	6.45	8.43	1.21	6.56	1.43	7.68	1.21	2.95	4.82	0.00	3.14	0.32	44.20
1949	11.53	3.77	0.85	0.53	0.94	2.60	0.59	0.47	0.10	0.31	1.43	1.87	24.99
1950	10.62	1.31	0.55	10.77	1.34	0.75	0.52	2.53	1.93	0.73	12.18	8.46	51.69
1951	1.67	7.70	22.12	2.48	2.42	1.02	1.30	1.51	1.87	4.98	0.61	3.60	51.28
1952	7.24	0.89	2.16	0.08	1.52	1.12	1.76	0.20	0.94	4.38	2.62	1.67	24.58
1953	2.27	1.29	2.41	1.05	2.67	0.33	0.30	0.27	0.05	0.85	0.42	3.42	15.33
1954	0.97	5.17	5.34	2.08	0.97	0.87	4.87	0.76	0.26	2.44	3.30	7.22	34.25
1955	4.72	6.38	3.81	0.66	0.73	0.47	0.90	2.48	4.16	0.37	13.18	12.38	50.24
1956	8.93	3.28	0.64	3.81	1.49	0.42	2.41	3.73	4.74	2.94	3.20	4.20	39.79
1957	6.00	1.66	0.61	2.85	3.60	0.14	0.59	2.92	1.03	0.45	8.51	4.27	32.63
1958	0.63	1.92	11.19	0.40	1.82	1.05	2.10	2.53	1.25	4.39	0.31	5.64	33.23
1959	12.39	4.06	0.17	1.33	1.69	0.51	0.69	0.57	3.42	0.77	5.32	1.05	31.97
1960	0.91	0.84	5.00	0.43	11.68	2.39	1.18	1.19	2.34	1.99	0.61	3.89	32.45
1961	6.72	1.98	0.63	2.78	1.07	1.14	1.54	0.62	0.97	7.12	9.93	1.31	35.81
1962	7.57	4.17	13.24	3.51	4.95	0.10	0.63	0.74	0.33	1.93	0.16	4.07	41.40
1963	16.32	2.11	9.98	7.23	7.46	1.23	1.45	1.39	1.50	4.00	0.70	4.91	58.28
1964	1.98	0.29	6.34	1.35	0.55	0.22	1.73	1.35	1.18	2.27	4.56	7.39	29.21
1965	5.28	5.87	1.85	5.33	7.79	0.51	1.30	4.17	4.59	5.93	17.76	1.17	61.55
1966	2.35	5.24	2.44	0.94	3.72	0.41	0.67	1.79	2.91	2.11	6.01	3.51	32.10
1967	7.04	2.33	10.22	3.96	9.02	2.35	7.34	2.58	2.99	2.34	5.31	9.80	65.28
1968	6.99	8.15	6.58	12.73	2.59	0.71	1.26	2.34	9.17	4.18	4.36	8.08	67.14
1969	10.22	1.86	3.84	0.80	0.48	1.07	1.38	0.26	2.26	1.03	0.81	5.85	29.86
1970	5.58	1.77	0.38	2.79	0.78	1.85	1.30	2.28	0.24	1.56	11.58	0.56	30.67
1971	16.12	1.69	4.18	1.13	1.29	0.16	0.34	0.31	0.49	0.65	0.48	0.71	27.55
1972	4.97	8.28	5.13	1.81	0.47	1.82	0.26	0.56	1.81	1.76	0.29	3.02	30.18
1973	2.46	0.39	0.47	0.71	2.73	0.23	0.13	2.13	1.27	1.61	8.60	7.26	27.99
1974	10.22	2.76	5.93	1.97	1.58	3.64	3.61	0.49	8.59	2.67	3.07	0.52	45.05
1975	8.94	6.51	1.84	1.47	0.03	0.09	0.70	0.13	0.98	0.32	2.15	0.95	24.11

END_DATE	PAN EVAPORATION (inches)
31-Jan-57	1.73
28-Feb-57	2.35
31-Mar-57	2.45
30-Apr-57	2.58
31-May-57	2.18
30-Jun-57	2.07
31-Jul-57	2.64
31-Aug-57	2.35
30-Sep-57	2.11
31-Oct-57	2.67
30-Nov-57	1.00
31-Dec-57	1.50
31-Jan-58	2.60
28-Feb-58	1.31
31-Mar-58	2.65
30-Apr-58	2.70
31-May-58	1.95
30-Jun-58	2.07
31-Jul-58	5.19

LANAI PAN EVAPORATION DATA- STA. NO 68



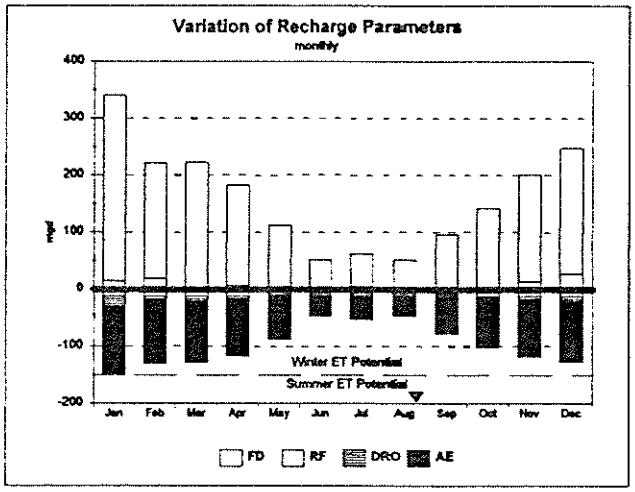
END_DATE	FD inches
31-Jul-55	1.05
31-Aug-55	1.83
30-Sep-55	0.00
31-Oct-55	1.02
30-Nov-55	3.51
31-Dec-55	3.28
31-Jan-56	2.84
29-Feb-56	4.54
31-Mar-56	1.94
30-Apr-56	1.28
31-May-56	2.44
30-Jun-56	3.93
31-Jul-56	1.24
31-Aug-56	4.07
30-Sep-56	0.42
31-Oct-56	1.49
30-Nov-56	0.82
31-Dec-56	3.45
31-Jan-57	3.92
28-Feb-57	1.38
31-Mar-57	0.42
30-Apr-57	1.40
31-May-57	1.89
30-Jun-57	0.06
31-Jul-57	2.73
31-Aug-57	6.47
30-Sep-57	2.59
31-Oct-57	1.30
30-Nov-57	5.55
31-Dec-57	6.14
31-Jan-58	2.07
28-Feb-58	1.73
31-Mar-58	3.58
30-Apr-58	1.10
31-May-58	5.09
30-Jun-58	2.76
31-Jul-58	1.39

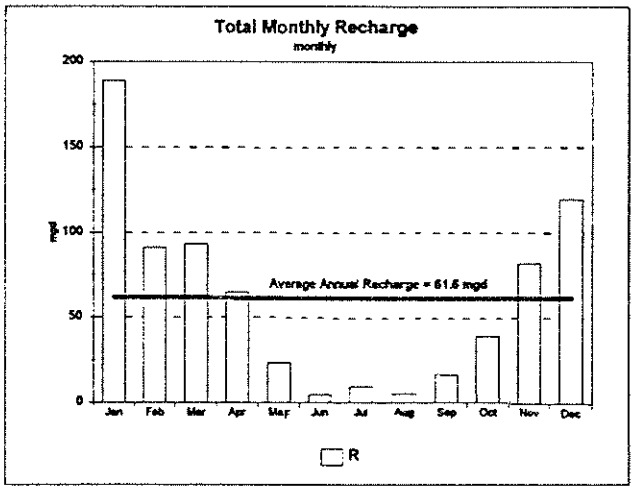

LANAI FOG DRIP STUDY
inches
10
9
8
7
6
5
4
3
2
1
0
Monthly Average = 2.5
44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
date (period 7/55 to 7/58)
monthly

APPENDIX B

Recharge Parameters for Steady-State GIS, in mgd

	FD	RF	DRO	AE	R	GIS R
Jan	14.75	325.14	-29.32	-121.66	188.91	189.29
Feb	19.31	202.36	-18.36	-111.92	91.39	92.1
Mar	3.31	219.73	-19.88	-109.52	93.64	93.94
Apr	6.91	175.88	-15.96	-101.68	65.15	65.16
May	3.88	108.05	-9.75	-78.92	23.26	23.23
Jun	2.46	49.53	-4.46	-42.89	4.64	5.3
Jul	4.72	57.84	-5.19	-48.15	9.22	9.43
Aug	3.21	49.33	-4.43	-42.96	5.15	5.76
Sep	3.45	92.20	-8.29	-70.41	16.95	16.65
Oct	3.92	138.15	-12.49	-90.05	39.53	39.34
Nov	13.54	187.33	-16.97	-101.98	81.92	78.21
Dec	27.00	220.40	-19.88	-107.96	119.56	120.81
Average	8.87	152.16	-13.75	-85.68	61.61	61.60





APPENDIX C

Lanai BAS BASIC MASTER INPUT FILE PACKAGE

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C
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11 12 13 14 0 0 0 18 19 0 0 22 0 0 0 26 0 0 0
     0     1
     5     1(25I3)              0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0
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0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
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0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
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0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 0 0 0 0 0 0 0 0
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1 1 1 1 0 0 0 0 0 0 0
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1 1 1 1 1 0 0 0 0 0 0
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1 1 1 1 1 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 0 0 0 0
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1 1 1 1 1 1 1 1 0 0 0
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1 1 1 1 1 1 1 1 1 1 0
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0 0 0 0 0 0 0 0 0 0 0
-0.0000
   -35
  1.0000      1   1.0000
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LANAI BCF BLOCK CENTERED CONTROL PACKAGE

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 1
     0     1.(20F4.1)              -1     xy anisotropy
     0   2000.0(10E12.4)             -1     row length
     0   2000.0                  -1     col length
    11    1.000(10E12.4)                 Kh
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 1.0000e+03 1.0000e+03 1.0000e+03 1.0000e+03 1.0000e+03 1.0000e+03
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1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	100.00e+00	100.00e+00	100.00e+00	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	1.0000e+03	
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	100.00e+00	100.00e+00	100.00e+00	100.00e+00
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03				
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03
1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03	1.0000e+03

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0.6260E+01 0.9390E+01 0.1088E+02 0.1096E+02 0.4390E+01 0.4000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.6540E+01 0.8740E+01 0.7520E+01 0.3830E+01 0.3160E+01 0.4930E+01
0.4450E+01 0.4020E+01 0.4960E+01 0.6220E+01 0.6480E+01 0.7190E+01 0.6430E+01 0.7070E+01 0.6160E+01 0.3900E+00
0.0000E+00 0.5870E+01 0.1468E+02 0.3291E+02 0.3346E+02 0.3538E+02 0.1700E+02 0.1220E+02 0.1089E+02 0.1088E+02
0.9720E+01 0.1094E+02 0.9150E+01 0.8890E+01 0.4280E+01 0.3800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.8280E+01 0.7330E+01 0.4080E+01 0.2960E+01 0.3550E+01 0.4830E+01
0.3750E+01 0.4930E+01 0.4690E+01 0.4750E+01 0.6110E+01 0.6300E+01 0.5920E+01 0.7160E+01 0.7470E+01 0.1870E+01
0.2500E+01 0.7740E+01 0.2301E+02 0.3675E+02 0.3814E+02 0.3341E+02 0.3024E+02 0.2513E+02 0.1509E+02 0.1275E+02
0.1090E+02 0.1194E+02 0.9280E+01 0.7880E+01 0.4880E+01 0.4100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.9200E+00 0.1006E+02 0.8180E+01 0.4210E+01 0.2650E+01 0.3280E+01 0.4420E+01
0.2980E+01 0.4550E+01 0.2750E+01 0.4480E+01 0.4090E+01 0.2700E+01 0.3540E+01 0.7480E+01 0.8590E+01 0.7040E+01
0.1180E+01 0.3410E+01 0.2328E+02 0.3659E+02 0.3830E+02 0.4091E+02 0.3999E+02 0.3429E+02 0.2178E+02 0.1758E+02
0.1425E+02 0.1044E+02 0.9390E+01 0.9710E+01 0.7400E+01 0.5900E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.8000E-01 0.8560E+01 0.8870E+01 0.7340E+01 0.3150E+01 0.9700E+00 0.4250E+01
0.3230E+01 0.4890E+01 0.3650E+01 0.3400E+01 0.2790E+01 0.3780E+01 0.3960E+01 0.7310E+01 0.8570E+01 0.3740E+01
0.3030E+01 0.1050E+01 0.2106E+02 0.3381E+02 0.3667E+02 0.3926E+02 0.3837E+02 0.2735E+02 0.2154E+02 0.1641E+02
0.1370E+02 0.1020E+02 0.9920E+01 0.8550E+01 0.6490E+01 0.3800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.1230E+01 0.8880E+01 0.9540E+01 0.9230E+01 0.6870E+01 0.1500E+01 0.2330E+01
0.3340E+01 0.4920E+01 0.3740E+01 0.4200E+01 0.4140E+01 0.4800E+01 0.7330E+01 0.7710E+01 0.8340E+01 0.9280E+01
0.3610E+01 0.1142E+02 0.9190E+01 0.3423E+02 0.3655E+02 0.3714E+02 0.3481E+02 0.3369E+02 0.2524E+02 0.1906E+02
0.1418E+02 0.6420E+01 0.8490E+01 0.6790E+01 0.7090E+01 0.2100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.4090E+01 0.8900E+01 0.9030E+01 0.8980E+01 0.7050E+01 0.5310E+01 0.3560E+01
0.2500E+01 0.4450E+01 0.4900E+01 0.3510E+01 0.3260E+01 0.5690E+01 0.7270E+01 0.7750E+01 0.7920E+01 0.9170E+01
0.9040E+01 0.7930E+01 0.1149E+02 0.3351E+02 0.3617E+02 0.3619E+02 0.3146E+02 0.3333E+02 0.2809E+02 0.1881E+02
0.1329E+02 0.9690E+01 0.9920E+01 0.8850E+01 0.7980E+01 0.2800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.2460E+01 0.6680E+01 0.8580E+01 0.8930E+01 0.9370E+01 0.8550E+01 0.7840E+01
0.7380E+01 0.4030E+01 0.4050E+01 0.2920E+01 0.4020E+01 0.5380E+01 0.6690E+01 0.7520E+01 0.7590E+01 0.7860E+01
0.6560E+01 0.5740E+01 0.1247E+02 0.3591E+02 0.3624E+02 0.3400E+02 0.3189E+02 0.3058E+02 0.2275E+02 0.1243E+02
0.1668E+02 0.1573E+02 0.1131E+02 0.8050E+01 0.5860E+01 0.6000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.4600E+00 0.5130E+01 0.8490E+01 0.8860E+01 0.8800E+01 0.8080E+01
0.7570E+01 0.6520E+01 0.3110E+01 0.2300E+01 0.2900E+01 0.2480E+01 0.3790E+01 0.4580E+01 0.4380E+01 0.7760E+01
0.7000E+01 0.4010E+01 0.2380E+02 0.3314E+02 0.3442E+02 0.3402E+02 0.3649E+02 0.3057E+02 0.1934E+02 0.1442E+02
0.1067E+02 0.5070E+01 0.6900E+01 0.7490E+01 0.5080E+01 0.3000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.3430E+01 0.8380E+01 0.8790E+01 0.8830E+01
0.8210E+01 0.8120E+01 0.8030E+01 0.4150E+01 0.2670E+01 0.2240E+01 0.2850E+01 0.3890E+01 0.4790E+01 0.5350E+01
0.3750E+01 0.2060E+01 0.2456E+02 0.3025E+02 0.3041E+02 0.3914E+02 0.3447E+02 0.2537E+02 0.1370E+02 0.1066E+02
0.8120E+01 0.1108E+02 0.1132E+02 0.1017E+02 0.2890E+01 0.2800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.3370E+01 0.8390E+01 0.8800E+01
0.9060E+01 0.9050E+01 0.8440E+01 0.7610E+01 0.4460E+01 0.5920E+01 0.3400E+01 0.2020E+01 0.1730E+01 0.3240E+01
0.3250E+01 0.4570E+01 0.1840E+02 0.2458E+02 0.2889E+02 0.3997E+02 0.3254E+02 0.2007E+02 0.8720E+01 0.6530E+01
0.7960E+01 0.9430E+01 0.7230E+01 0.7650E+01 0.5280E+01 0.5000E-01
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.2720E+01 0.7900E+01
0.9020E+01 0.8930E+01 0.8750E+01 0.8760E+01 0.8960E+01 0.8630E+01 0.8950E+01 0.4690E+01 0.1380E+01 0.9700E+00
0.5580E+01 0.5740E+01 0.1250E+02 0.1993E+02 0.2221E+02 0.3610E+02 0.2649E+02 0.6650E+01 0.9920E+01 0.4690E+01
0.2280E+01 0.4590E+01 0.7660E+01 0.8180E+01 0.2800E+01 0.0000E+00
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0.7110E+01 0.8370E+01 0.8680E+01 0.9030E+01 0.9210E+01 0.1075E+02 0.1504E+02 0.1157E+02 0.3900E+01 0.7060E+01
0.6510E+01 0.4160E+01 0.2361E+02 0.3442E+02 0.3009E+02 0.2575E+02 0.1663E+02 0.7960E+01 0.1008E+02 0.9330E+01
0.5570E+01 0.7820E+01 0.8120E+01 0.7670E+01 0.1310E+01 0.0000E+00
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0.1280E+01 0.6230E+01 0.8000E+01 0.8850E+01 0.9550E+01 0.1019E+02 0.1039E+02 0.9730E+01 0.8220E+01 0.8320E+01

0.7090E+01 0.8880E+01 0.1234E+02 0.1692E+02 0.1285E+02 0.1343E+02 0.1162E+02 0.1097E+02 0.9670E+01 0.1058E+02
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0.9270E+01 0.8420E+01 0.8870E+01 0.1086E+02 0.8850E+01 0.9970E+01 0.9190E+01 0.7310E+01 0.1084E+02 0.8130E+01
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0.1282E+02 0.8510E+01 0.9270E+01 0.1011E+02 0.8720E+01 0.9060E+01 0.1021E+02 0.7700E+01 0.1047E+02 0.8280E+01
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LANAI BND HORIZONTAL FLOW BOUNDARY PACKAGE

895

895

33	30	33	310.00005010
33	29	33	300.00005010
38	29	38	300.00005010
33	29	34	290.00005010
37	29	38	290.00005010
33	28	34	280.00005010
28	27	28	280.00005010
28	27	29	270.00005010
29	26	29	270.00005010
34	26	34	270.00005010
29	26	30	260.00005010
34	26	35	260.00005010
30	25	30	260.00005010
31	25	31	260.00005010
32	25	32	260.00005010
35	25	35	260.00005010
41	25	41	260.00005010
42	25	42	260.00005010
47	25	47	260.00005010
32	24	32	250.00005010
33	24	33	250.00005010
37	23	37	240.00005010
40	23	40	240.00005010
37	23	38	230.00005010
40	23	41	230.00005010
45	21	45	220.00005010
48	21	48	220.00005010
46	18	46	190.00005010
46	17	46	180.00005010
45	16	45	170.00005010
45	15	45	160.00005010
40	17	41	170.00005010
41	16	41	170.00005010
41	16	42	160.00005010
42	15	42	160.00005010
42	15	43	150.00005010
43	14	43	150.00005010
43	14	44	140.00005010
44	13	44	140.00005010
14	13	15	130.00005010
10	12	11	120.00005010
11	12	12	120.00005010
9	11	10	110.00005010
41	10	42	100.00005010
42	9	42	100.00005010
40	9	41	90.00005010
41	8	41	90.00005010
39	8	40	80.00005010
40	7	40	80.00005010
41	13	42	130.00005010
42	12	42	130.00005010
42	12	43	120.00005010
39	11	40	110.00005010
40	10	40	110.00005010
40	10	41	100.00005010
40	25	41	250.00005010
42	26	43	260.00005010
38	22	38	230.00005010
35	4	36	40.00005010
34	4	35	40.00005010
33	4	34	40.00005010
32	4	33	40.00005010
31	4	32	40.00005010
31	5	32	50.00005010
31	6	32	60.00005010
31	7	32	70.00005010
31	8	32	80.00005010
31	9	32	90.00005010
31	10	32	100.00005010
31	11	32	110.00005010
31	12	32	120.00005010
31	13	32	130.00005010
31	14	32	140.00005010
31	15	32	150.00005010
31	16	32	160.00005010
31	17	32	170.00005010
32	4	32	50.00005010
32	5	32	60.00005010
32	6	32	70.00005010
32	7	32	80.00005010
32	8	32	90.00005010
32	9	32	100.00005010
32	10	32	110.00005010
32	11	32	120.00005010

32	12	32	130.00005010
32	13	32	140.00005010
32	14	32	150.00005010
32	15	32	160.00005010
32	16	32	170.00005010
32	17	32	180.00005010
32	5	33	50.00005010
32	6	33	60.00005010
32	7	33	70.00005010
32	8	33	80.00005010
32	9	33	90.00005010
32	10	33	100.00005010
32	11	33	110.00005010
32	12	33	120.00005010
33	4	33	50.00005010
33	5	33	60.00005010
33	6	33	70.00005010
33	7	33	80.00005010
33	8	33	90.00005010
33	9	33	100.00005010
33	10	33	110.00005010
33	11	33	120.00005010
33	5	34	50.00005010
33	6	34	60.00005010
33	7	34	70.00005010
33	8	34	80.00005010
33	9	34	90.00005010
33	10	34	100.00005010
33	11	34	110.00005010
34	4	34	50.00005010
34	5	34	60.00005010
34	6	34	70.00005010
34	7	34	80.00005010
34	8	34	90.00005010
34	9	34	100.00005010
34	10	34	110.00005010
34	11	34	120.00005010
34	5	35	50.00005010
34	6	35	60.00005010
34	7	35	70.00005010
34	8	35	80.00005010
34	9	35	90.00005010
34	10	35	100.00005010
34	11	35	110.00005010
35	4	35	50.00005010
35	5	35	60.00005010
35	6	35	70.00005010
35	7	35	80.00005010
35	8	35	90.00005010
35	9	35	100.00005010
35	10	35	110.00005010
35	11	35	120.00005010
35	5	36	50.00005010
35	6	36	60.00005010
35	7	36	70.00005010
35	8	36	80.00005010
35	9	36	90.00005010
35	10	36	100.00005010
35	11	36	110.00005010
35	12	36	120.00005010
35	13	36	130.00005010
36	12	36	130.00005010
36	12	37	120.00005010
36	13	37	130.00005010
37	11	37	120.00005010
37	12	37	130.00005010
37	11	38	110.00005010
37	12	38	120.00005010
37	13	38	130.00005010
38	10	38	110.00005010
38	11	38	120.00005010
38	12	38	130.00005010
38	9	39	90.00005010
38	10	39	100.00005010
38	11	39	110.00005010
38	12	39	120.00005010
38	13	39	130.00005010
38	14	39	140.00005010
38	15	39	150.00005010
38	16	39	160.00005010
39	8	39	90.00005010
39	9	39	100.00005010
39	10	39	110.00005010
39	11	39	120.00005010
39	12	39	130.00005010
39	13	39	140.00005010
39	14	39	150.00005010

39	16	39	170.00005010
39	9	40	90.00005010
39	10	40	100.00005010
39	12	40	120.00005010
39	13	40	130.00005010
40	9	40	100.00005010
40	11	40	120.00005010
40	12	40	130.00005010
40	11	41	110.00005010
40	12	41	120.00005010
41	9	41	100.00005010
41	10	41	110.00005010
41	11	41	120.00005010
41	11	42	110.00005010
42	10	42	110.00005010
39	17	40	170.00005010
43	11	43	120.00005010
41	13	41	140.00005010
40	14	41	140.00005010
40	14	40	150.00005010
44	12	44	130.00005010
43	13	44	130.00005010
43	13	43	140.00005010
42	14	43	140.00005010
42	14	42	150.00005010
41	15	42	150.00005010
41	15	41	160.00005010
40	16	41	160.00005010
40	16	40	170.00005010
45	14	45	150.00005010
44	15	45	150.00005010
44	15	44	160.00005010
43	16	44	160.00005010
43	16	43	170.00005010
42	16	43	160.00005010
42	16	42	170.00005010
41	17	42	170.00005010
41	17	41	180.00005010
40	17	40	180.00005010
40	18	41	180.00005010
40	18	40	190.00005010
40	19	40	200.00005010
40	20	40	210.00005010
40	21	40	220.00005010
40	22	40	230.00005010
40	24	40	250.00005010
40	25	40	260.00005010
40	26	40	270.00005010
40	19	41	190.00005010
40	20	41	200.00005010
40	21	41	210.00005010
40	22	41	220.00005010
40	24	41	240.00005010
40	26	41	260.00005010
41	18	41	190.00005010
41	19	41	200.00005010
41	20	41	210.00005010
41	21	41	220.00005010
41	22	41	230.00005010
41	23	41	240.00005010
41	24	41	250.00005010
41	26	41	270.00005010
41	18	42	180.00005010
41	19	42	190.00005010
41	20	42	200.00005010
41	21	42	210.00005010
41	22	42	220.00005010
41	23	42	230.00005010
41	25	42	250.00005010
41	26	42	260.00005010
42	17	42	180.00005010
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16	14	17	140.00005010	
31	4	31	50.00005010	
30	4	30	50.00005010	
28	5	28	60.00005010	
23	11	23	120.00005010	
23	23	24	230.00005010	new addition
24	23	24	240.00005010	
24	23	25	230.00005010	
24	24	25	240.00005010	
25	23	25	240.00005010	
25	24	25	250.00005010	
25	23	26	230.00005010	
25	24	26	240.00005010	
25	25	26	250.00005010	
26	23	26	240.00005010	
26	24	26	250.00005010	
26	25	26	260.00005010	
26	23	27	230.00005010	
26	24	27	240.00005010	
26	25	27	250.00005010	
26	26	27	260.00005010	
27	23	27	240.00005010	
27	24	27	250.00005010	
27	25	27	260.00005010	
27	26	27	270.00005010	
33	28	33	290.00005010	

LANAI RIV RIVER PACKAGE

```
164    -1
164
  1    2    13   0.000 4.000e+08-1.000e+01
  1    2    14   0.000 4.000e+08-1.000e+01
  1    2    15   0.000 4.000e+08-1.000e+01
  1    2    16   0.000 4.000e+08-1.000e+01
  1    2    17   0.000 4.000e+08-1.000e+01
  1    3    17   0.000 4.000e+08-1.000e+01
  1    3    18   0.000 4.000e+04-1.000e+01
  1    3    19   0.000 4.000e+04-1.000e+01
  1    3    20   0.000 4.000e+04-1.000e+01
  1    4    20   0.000 4.000e+04-1.000e+01
  1    4    21   0.000 4.000e+04-1.000e+01
  1    4    22   0.000 4.000e+04-1.000e+01
  1    5    22   0.000 4.000e+04-1.000e+01
  1    5    23   0.000 4.000e+04-1.000e+01
  1    6    23   0.000 4.000e+04-1.000e+01
  1    6    24   0.000 4.000e+04-1.000e+01
  1    7    24   0.000 4.000e+04-1.000e+01
  1    7    25   0.000 4.000e+04-1.000e+01
  1    8    25   0.000 4.000e+04-1.000e+01
  1    8    26   0.000 4.000e+04-1.000e+01
  1    9    26   0.000 4.000e+04-1.000e+01
  1    9    27   0.000 4.000e+04-1.000e+01
  1    10   27   0.000 4.000e+04-1.000e+01
  1    11   27   0.000 4.000e+04-1.000e+01
  1    11   28   0.000 4.000e+04-1.000e+01
  1    12   28   0.000 4.000e+04-1.000e+01
  1    12   29   0.000 4.000e+04-1.000e+01
  1    13   29   0.000 4.000e+04-1.000e+01
  1    13   30   0.000 4.000e+04-1.000e+01
  1    14   30   0.000 4.000e+04-1.000e+01
  1    14   31   0.000 4.000e+04-1.000e+01
  1    15   31   0.000 4.000e+04-1.000e+01
  1    15   32   0.000 4.000e+04-1.000e+01
  1    16   32   0.000 4.000e+04-1.000e+01
  1    17   32   0.000 4.000e+04-1.000e+01
  1    17   33   0.000 4.000e+04-1.000e+01
  1    18   33   0.000 4.000e+04-1.000e+01
  1    18   34   0.000 4.000e+04-1.000e+01
  1    19   34   0.000 4.000e+04-1.000e+01
  1    20   34   0.000 4.000e+04-1.000e+01
  1    20   35   0.000 4.000e+04-1.000e+01
  1    21   35   0.000 4.000e+04-1.000e+01
  1    22   35   0.000 4.000e+04-1.000e+01
  1    23   35   0.000 4.000e+04-1.000e+01
  1    24   35   0.000 4.000e+04-1.000e+01
  1    25   35   0.000 4.000e+04-1.000e+01
  1    26   35   0.000 4.000e+04-1.000e+01
  1    27   35   0.000 4.000e+08-1.000e+01
  1    28   35   0.000 4.000e+04-1.000e+01
  1    29   35   0.000 4.000e+04-1.000e+01
  1    30   35   0.000 4.000e+04-1.000e+01
  1    31   35   0.000 4.000e+04-1.000e+01
  1    32   35   0.000 4.000e+04-1.000e+01
  1    33   35   0.000 4.000e+04-1.000e+01
  1    34   35   0.000 4.000e+04-1.000e+01
  1    35   35   0.000 4.000e+04-1.000e+01
  1    36   35   0.000 4.000e+04-1.000e+01
  1    37   35   0.000 4.000e+04-1.000e+01
  1    38   35   0.000 4.000e+04-1.000e+01
  1    39   35   0.000 4.000e+04-1.000e+01
  1    40   35   0.000 4.000e+04-1.000e+01
  1    41   35   0.000 4.000e+04-1.000e+01
  1    42   35   0.000 4.000e+04-1.000e+01
  1    42   34   0.000 4.000e+04-1.000e+01
  1    43   34   0.000 4.000e+04-1.000e+01
  1    44   34   0.000 4.000e+04-1.000e+01
  1    45   34   0.000 4.000e+04-1.000e+01
  1    45   33   0.000 4.000e+04-1.000e+01
  1    46   33   0.000 4.000e+04-1.000e+01
  1    46   32   0.000 4.000e+04-1.000e+01
  1    47   32   0.000 4.000e+04-1.000e+01
  1    47   30   0.000 4.000e+04-1.000e+01
  1    47   31   0.000 4.000e+04-1.000e+01
  1    48   25   0.000 4.000e+04-1.000e+01
  1    48   26   0.000 4.000e+04-1.000e+01
  1    48   27   0.000 4.000e+04-1.000e+01
  1    48   28   0.000 4.000e+04-1.000e+01
  1    48   29   0.000 4.000e+04-1.000e+01
  1    48   30   0.000 4.000e+04-1.000e+01
  1    49   20   0.000 4.000e+08-1.000e+01
  1    49   21   0.000 4.000e+08-1.000e+01
  1    49   22   0.000 4.000e+08-1.000e+01
  1    49   23   0.000 4.000e+08-1.000e+01
  1    49   24   0.000 4.000e+08-1.000e+01
```

1	49	25	0.000 4.000e+08-1.000e+01
1	48	19	0.000 4.000e+08-1.000e+01
1	48	20	0.000 4.000e+08-1.000e+01
1	47	15	0.000 4.000e+08-1.000e+01
1	47	16	0.000 4.000e+08-1.000e+01
1	47	17	0.000 4.000e+08-1.000e+01
1	47	18	0.000 4.000e+08-1.000e+01
1	47	19	0.000 4.000e+08-1.000e+01
1	46	11	0.000 4.000e+08-1.000e+01
1	46	12	0.000 4.000e+08-1.000e+01
1	46	13	0.000 4.000e+08-1.000e+01
1	46	14	0.000 4.000e+08-1.000e+01
1	46	15	0.000 4.000e+08-1.000e+01
1	44	11	0.000 4.000e+08-1.000e+01
1	45	11	0.000 4.000e+08-1.000e+01
1	44	10	0.000 4.000e+08-1.000e+01
1	43	10	0.000 4.000e+08-1.000e+01
1	43	9	0.000 4.000e+08-1.000e+01
1	42	9	0.000 4.000e+08-1.000e+01
1	42	7	0.000 4.000e+08-1.000e+01
1	42	8	0.000 4.000e+08-1.000e+01
1	41	7	0.000 4.000e+08-1.000e+01
1	41	6	0.000 4.000e+08-1.000e+01
1	40	5	0.000 4.000e+08-1.000e+01
1	40	6	0.000 4.000e+08-1.000e+01
1	39	4	0.000 4.000e+08-1.000e+01
1	39	5	0.000 4.000e+08-1.000e+01
1	38	3	0.000 4.000e+08-1.000e+01
1	38	4	0.000 4.000e+08-1.000e+01
1	37	2	0.000 4.000e+08-1.000e+01
1	37	3	0.000 4.000e+08-1.000e+01
1	35	2	0.000 4.000e+08-1.000e+01
1	36	2	0.000 4.000e+08-1.000e+01
1	35	3	0.000 4.000e+08-1.000e+01
1	30	3	0.000 4.000e+08-1.000e+01
1	31	3	0.000 4.000e+08-1.000e+01
1	32	3	0.000 4.000e+08-1.000e+01
1	33	3	0.000 4.000e+08-1.000e+01
1	34	3	0.000 4.000e+08-1.000e+01
1	30	4	0.000 4.000e+08-1.000e+01
1	28	4	0.000 4.000e+08-1.000e+01
1	29	4	0.000 4.000e+08-1.000e+01
1	26	5	0.000 4.000e+08-1.000e+01
1	27	5	0.000 4.000e+08-1.000e+01
1	28	5	0.000 4.000e+08-1.000e+01
1	26	6	0.000 4.000e+08-1.000e+01
1	26	7	0.000 4.000e+08-1.000e+01
1	25	7	0.000 4.000e+08-1.000e+01
1	25	8	0.000 4.000e+08-1.000e+01
1	24	8	0.000 4.000e+08-1.000e+01
1	24	9	0.000 4.000e+08-1.000e+01
1	23	9	0.000 4.000e+08-1.000e+01
1	23	10	0.000 4.000e+08-1.000e+01
1	22	10	0.000 4.000e+08-1.000e+01
1	22	11	0.000 4.000e+08-1.000e+01
1	19	11	0.000 4.000e+08-1.000e+01
1	20	11	0.000 4.000e+08-1.000e+01
1	21	11	0.000 4.000e+08-1.000e+01
1	14	12	0.000 4.000e+08-1.000e+01
1	15	12	0.000 4.000e+08-1.000e+01
1	16	12	0.000 4.000e+08-1.000e+01
1	17	12	0.000 4.000e+08-1.000e+01
1	18	12	0.000 4.000e+08-1.000e+01
1	19	12	0.000 4.000e+08-1.000e+01
1	12	11	0.000 4.000e+08-1.000e+01
1	13	11	0.000 4.000e+08-1.000e+01
1	14	11	0.000 4.000e+08-1.000e+01
1	5	10	0.000 4.000e+08-1.000e+01
1	6	10	0.000 4.000e+08-1.000e+01
1	7	10	0.000 4.000e+08-1.000e+01
1	8	10	0.000 4.000e+08-1.000e+01
1	9	10	0.000 4.000e+08-1.000e+01
1	10	10	0.000 4.000e+08-1.000e+01
1	11	10	0.000 4.000e+08-1.000e+01
1	12	10	0.000 4.000e+08-1.000e+01
1	4	11	0.000 4.000e+08-1.000e+01
1	5	11	0.000 4.000e+08-1.000e+01
1	3	12	0.000 4.000e+08-1.000e+01
1	4	12	0.000 4.000e+08-1.000e+01
1	3	13	0.000 4.000e+08-1.000e+01

LANAI.DRN

```
  3    -1
  3
  1    32    25    1103    255.84    lower tunnel
  1    33    25    1500    1370.00    upper tunnel
  1    33    24    1500    1370.00    extension of upper
 -1
 -1
 -1
 -1
 -1
 -1
 -1
```

LANAI.WEL CALIBRATED INITIAL STEADY-STATE

```
 22    0
 22
  1    44    16    0.000
  1    44    15    0.000
  1    43    13    0.000
  1    38    12    0.000
  1    39    23    0.000
  1    39    24    0.000
  1    38    34    0.000
  1    37    22    0.000
  1    36    23    0.000
  1    36    24    0.000
  1    35    22    0.000
  1    36    20    0.000
  1    33    19    0.000
  1    33    25    0.000
  1    32    25    0.000
  1    30    26    0.000
  1    30    23    0.000
  1    29    23    0.000
  1    27    22    0.000
  1    27    31    0.000
  1    31    22    0.000
  1    32    21    0.000
```

LANAI.WEL LONGTERM PUMPAGE

```
 22    0
 22
  1    44    16    0.000        well 13
  1    44    15    0.000        well 12
  1    43    13    0.000        manele
  1    38    12    0.000        well 10
  1    39    23-20737.6         well 5
  1    39    24    0.000        dry
  1    38    34    0.000        gay
  1    37    22    0.000        dry
  1    36    23-36483.9         well 4
  1    36    24    0.000        dry
  1    35    22-83020.8         well 2 sht 3
  1    36    20-15479.0         well 1
  1    33    19 -1570.8         well 9
  1    33    25    0.000        upper
  1    32    25    0.000        lower
  1    30    26-26190.1         sht 2
  1    30    23    0.000        T-3
  1    29    23 -3919.3         well 6
  1    27    22    0.000        well 7
  1    27    30    0.000        sht 1
  1    31    22    0.000        well 8
  1    32    21-27398.1         well 3
```

LANAI.SIP STRDNGLY IMPLICIT PROCEDURE PACKAGE

```
 25000     5
 1.0000   0.001     1     1     1
```

LANAI.OC OUTPUT CONTROL PACKAGE

```
  0    0    30    40
  0    1    0     1
  1    0    1     1
```

APPENDIX D

LANAI OUTPUT RESULTS (BINARY FILES ARE EXCLUDED AND USED IN CREATING REPORT FIGURES)

```
1              U.S. GEOLOGICAL SURVEY MODULAR FINITE-DIFFERENCE GROUND-WATER MODEL
0Lanai: Kh=1000, HB=895, R=61.6, P=0, K/W=5.01E-5, SC is South=4E8 North=4E4),   Khc=100,Drains (lower DC=255.8 upper DC=1370, ex
  1 LAYERS      50 ROWS      36 COLUMNS
  1 STRESS PERIOD(S) IN SIMULATION
 MODEL TIME UNIT IS DAYS
0I/O UNITS:
 ELEMENT OF IUNIT:  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
      I/O UNIT: 11 12 13 14  0  0  0 18 19  0  0 22  0  0  0 26  0  0  0  0  0  0  0  0
0BAS1 -- BASIC MODEL PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM UNIT  5
 ARRAYS RHS AND BUFF WILL SHARE MEMORY.
 START HEAD WILL BE SAVED
   16290 ELEMENTS IN X ARRAY ARE USED BY BAS
   16290 ELEMENTS OF X ARRAY USED OUT OF  350000
0BCF3 -- BLOCK-CENTERED FLOW PACKAGE, VERSION 3, 7/9/92 INPUT READ FROM UNIT 11
 STEADY-STATE SIMULATION
 CONSTANT HEAD CELL-BY-CELL FLOWS WILL BE PRINTED
 HEAD AT CELLS THAT CONVERT TO DRY=  0.00000
 WETTING CAPABILITY IS NOT ACTIVE
    LAYER  AQUIFER TYPE    INTERBLOCK T
    ____________________
      1       1       0-HARMDNIC
   3601 ELEMENTS IN X ARRAY ARE USED BY BCF
   19691 ELEMENTS OF X ARRAY USED OUT OF  350000
0WEL1 -- WELL PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM 12
 MAXIMUM OF   22 WELLS
     88 ELEMENTS IN X ARRAY ARE USED FOR WELLS
   19979 ELEMENTS OF X ARRAY USED OUT OF  350000
0DRN1 -- DRAIN PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM UNIT 13
 MAXIMUM OF    3 DRAINS
 CELL-BY-CELL FLOWS WILL BE PRINTED WHEN ICBCFL NOT 0
     15 ELEMENTS IN X ARRAY ARE USED FOR DRAINS
   19994 ELEMENTS OF X ARRAY USED OUT OF  350000
0RCH1 -- RECHARGE PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM UNIT 18
 OPTION 1 -- RECHARGE TO TOP LAYER
    1800 ELEMENTS OF X ARRAY USED FOR RECHARGE
   21794 ELEMENTS OF X ARRAY USED OUT OF  350000
0RIV1 -- RIVER PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM UNIT 14
 MAXIMUM OF  164 RIVER NODES
 CELL-BY-CELL FLOWS WILL BE PRINTED
     984 ELEMENTS IN X ARRAY ARE USED FOR RIVERS
   22778 ELEMENTS OF X ARRAY USED OUT OF  350000
0SIP1 -- STRONGLY IMPLICIT PROCEDURE SOLUTION PACKAGE, VERSION 1, 9/1/87 INPUT READ FROM UNIT 19
 MAXIMUM OF**** ITERATIONS ALLOWED FOR CLOSURE
  5 ITERATION PARAMETERS
  107205 ELEMENTS IN X ARRAY ARE USED BY SIP
  129963 ELEMENTS OF X ARRAY USED OUT OF  350000
0HFB1 -- HORIZONTAL FLOW BARRIER PACKAGE, VERSION 1, 06/13/86 INPUT READ FROM UNIT 26
 A TOTAL OF  895 HORIZONTAL FLOW BARRIERS
  4475 ELEMENTS IN X ARRAY ARE USED FOR HORIZONTAL FLOW BARRIERS
 134458 ELEMENTS OF X ARRAY USED OUT OF 350000
1Lanai: Kh=1000, HB=895, R=61.6, P=0, K/W=5.01E-5, SC is South=4E8 North=4E4),   Khc=100,Drains (lower DC=255.8 upper DC=1370, ex
0
```

BOUNDARY ARRAY FOR LAYER 1 WILL BE READ ON UNIT 5 USING FORMAT: (25I3)

```
        1    2    3    4    5    6    7    8    9   10
       11   12   13   14   15   16   17   18   19   20
       21   22   23   24   25   26   27   28   29   30
       31   32   33   34   35   36
.......................................................
0 1     0    0    0    0    0    0    0    0    0    0
        0    0    0    0    0    0    0    0    0    0
        0    0    0    0    0    0    0    0    0    0
        0    0    0    0    0    0
0 2     0    0    0    0    0    0    0    0    0    0
        0    0    1    1    1    1    1    0    0    0
        0    0    0    0    0    0    0    0    0    0
        0    0    0    0    0    0
0 3     0    0    0    0    0    0    0    0    0    0
        0    1    1    1    1    1    1    1    1    1
        0    0    0    0    0    0    0    0    0    0
        0    0    0    0    0    0
0 4     0    0    0    0    0    0    0    0    0    0
        1    1    1    1    1    1    1    1    1    1
        1    1    0    0    0    0    0    0    0    0
        0    0    0    0    0    0
0 5     0    0    0    0    0    0    0    0    0    1
        1    1    1    1    1    1    1    1    1    1
        1    1    1    0    0    0    0    0    0    0
        0    0    0    0    0    0
0 6     0    0    0    0    0    0    0    0    0    1
        1    1    1    1    1    1    1    1    1    1
        1    1    1    1    0    0    0    0    0    0
```

	0	0	0	0	0	0				
0 7	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0	0	0	0	0
	0	0	0	0	0	0				
0 8	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	0	0	0	0
	0	0	0	0	0	0				
0 9	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	0	0	0
	0	0	0	0	0	0				
0 10	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	0	0	0
	0	0	0	0	0	0				
0 11	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	0	0
	0	0	0	0	0	0				
0 12	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	0
	0	0	0	0	0	0				
0 13	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0				
0 14	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	0	0	0	0	0				
0 15	0	0	0	0	0	0	0	0	0	0
	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	0	0	0	0				
0 16	0	0	0	0	0	0	0	0	0	0
	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	0	0	0	0				
0 17	0	0	0	0	0	0	0	0	0	0
	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	0	0	0				
0 18	0	0	0	0	0	0	0	0	0	0
	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	0	0				
0 19	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	0	0				
0 20	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 21	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 22	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 23	0	0	0	0	0	0	0	0	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 24	0	0	0	0	0	0	0	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 25	0	0	0	0	0	0	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 26	0	0	0	0	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 27	0	0	0	0	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 28	0	0	0	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1

	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 29	0	0	0	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 30	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 31	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 32	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 33	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 34	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 35	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 36	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 37	0	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 38	0	0	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 39	0	0	0	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 40	0	0	0	0	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 41	0	0	0	0	0	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 42	0	0	0	0	0	0	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	0				
0 43	0	0	0	0	0	0	0	0	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	0	0				
0 44	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	0	0				
0 45	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	0	0				
0 46	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	0	0	0				
0 47	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	0	0	0	0				
0 48	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	1	1
	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0				
0 49	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	1
	1	1	1	1	1	0	0	0	0	0
	0	0	0	0	0	0				
0 50	0	0	0	0	0	0	0	0	0	0

```
        0     0     0     0     0     0     0     0     0     0
        0     0     0     0     0     0     0     0     0     0
        0     0     0     0     0     0
0AQUIFER HEAD WILL BE SET TO 0.00000   AT ALL NO-FLOW NODES (IBOUND=0).
0

                    INITIAL HEAD, LAYER  1 WILL BE READ UNFORMATTED ON UNIT 35
                    ---------------------------------------------------------

        1     2     3     4     5     6     7     8     9    10
       11    12    13    14    15    16    17    18    19    20
       21    22    23    24    25    26    27    28    29    30
       31    32    33    34    35    36
.......................................................................
0 1  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 2  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   2.3181E-07 7.0108E-05 1.0295E-04 9.6275E-05 7.4483E-07 0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 3  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   3.4317E-07 1.6217E-04 7.0209E-02 0.1031   9.6448E-02 6.5004E-04 0.2544   0.3812   0.4357
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 4  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     3.3271E-07 1.8169E-04 9.2588E-02 0.1742   0.2313   0.2656   0.2916   0.4010   0.4871   0.5337
     0.5898   0.6046   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 5  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   2.1403E-07
     1.5168E-04 8.9400E-02 0.1907   0.2852   0.3623   0.4232   0.4789   0.5512   0.6142   0.6580
     0.6864   0.6796   0.6910   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 6  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   6.2780E-05
     6.2874E-02 0.1615   0.2766   0.3942   0.4892   0.5651   0.6304   0.6928   0.7445   0.7810
     0.8006   0.7969   0.7714   0.7732   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 7  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   8.9539E-05
     8.9719E-02 0.2062   0.3409   0.5058   0.6151   0.6987   0.7682   0.8276   0.8743   0.9056
     0.9204   0.9161   0.8930   0.8522   0.8435   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 8  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.5585E-05
     1.5523E-02 111.8    124.8    0.6528   0.7485   0.8300   0.8998   0.9583   1.003    1.031
     1.042    1.035    1.012    0.9720   0.9175   0.8997   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 9  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.8702E-05
     1.8729E-02 151.2    200.1    154.6    0.8785   0.9555   1.025    1.086    1.132    1.155
     1.162    1.152    1.128    1.089    1.035    0.9690   0.9430   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 10 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.3096E-05
     1.3107E-02 148.5    221.9    217.1    144.6    1.074    1.144    1.210    1.258    1.278
     1.280    1.268    1.243    1.202    1.148    1.082    1.009    0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 11 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   8.5463E-06
     8.5586E-03 109.4    178.1    192.7    190.4    137.0    1.260    1.331    1.377    1.396
     1.394    1.379    1.353    1.313    1.258    1.187    1.094    1.058    0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 12 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.1546E-07
     1.0715E-04 9.8929E-02 0.2101   0.2952   148.1    198.8    184.0    1.455    1.486    1.505
     1.505    1.487    1.460    1.420    1.366    1.300    1.219    1.128    1.085    0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 13 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     7.3922E-05 7.4030E-02 0.1968   0.3156   0.4178   172.3    255.0    235.3    1.587    1.607
     1.609    1.589    1.561    1.522    1.471    1.410    1.336    1.250    1.150    1.102
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 14 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     3.2287E-07 2.4960E-04 0.1763   0.3289   0.4593   0.5778   224.3    324.6    217.3    1.718
     1.708    1.684    1.653    1.617    1.573    1.515    1.446    1.366    1.270    1.163
     1.110    0.0000   0.0000   0.0000   0.0000   0.0000
0 15 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   1.7151E-04 0.1716   0.3405   0.4903   0.6224   0.7455   325.7    268.6    1.793
     1.790    1.771    1.742    1.710    1.669    1.615    1.550    1.474    1.382    1.278
     1.167    1.111    0.0000   0.0000   0.0000   0.0000
0 16 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   1.7374E-04 0.1738   0.3497   0.5160   0.6509   0.7588   365.8    383.3    206.6
     1.850    1.854    1.834    1.801    1.762    1.710    1.647    1.571    1.481    1.380
     1.272    1.166    0.0000   0.0000   0.0000   0.0000
0 17 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   2.0458E-04 0.2047   0.3957   0.5479   0.6804   0.7863   394.5    440.1    309.9
     173.8    1.957    1.933    1.894    1.852    1.798    1.735    1.659    1.569    1.470
     1.356    1.222    1.151    0.0000   0.0000   0.0000
0 18 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   2.1822E-04 0.2182   0.4157   0.5755   0.7089   0.8153   412.5    472.5    369.3
     252.1    2.026    2.017    1.983    1.937    1.880    1.818    1.738    1.650    1.553
     1.442    1.319    1.191    1.121    0.0000   0.0000
```

```
0 19  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     5.1780E-07 3.8427E-04 0.2507    0.4513    0.6095    0.7384    0.8396    419.6     491.5     417.7
     339.9     246.4     2.108     2.071     2.020     1.963     1.896     1.813     1.725     1.629
     1.522     1.402     1.278     1.162     0.0000    0.0000
0 20  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     1.3457E-04 0.1347    0.3276    0.5060    0.6517    0.7681    0.8566    410.9     508.6     457.6
     376.6     287.7     2.191     2.152     2.104     2.044     1.973     1.890     1.799     1.702
     1.592     1.470     1.338     1.192     1.111     0.0000
0 21  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     2.1068E-04 0.2107    0.4069    0.5724    0.7030    0.8070    0.8864    394.6     509.2     488.0
     392.4     271.8     2.266     2.230     2.180     2.119     2.050     1.966     1.871     1.769
     1.654     1.529     1.393     1.257     1.139     0.0000
0 22  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    6.7892E-07
     4.0927E-04 0.3008    0.4980    0.6490    0.7669    0.8595    0.9288    336.9     448.4     437.6
     376.0     270.7     2.337     2.297     2.253     2.190     2.120     2.037     1.941     1.834
     1.714     1.579     1.433     1.288     1.155     0.0000
0 23  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    5.8845E-07 2.7101E-04
     0.1097    0.4914    0.6120    0.7366    0.8403    0.9210    0.9804    251.9     367.9     401.1
     380.1     290.2     2.391     2.354     2.311     2.257     2.195     2.116     2.019     1.905
     1.774     1.622     1.456     1.291     1.143     0.0000
0 24  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    6.2931E-07 3.1862E-04 0.1623
     0.3281    0.5469    0.6979    0.8214    0.9223    1.000     1.054     231.4     356.3     416.9
     430.2     389.6     270.7     2.398     2.368     2.329     2.279     2.209     2.113     1.989
     1.840     1.661     1.463     1.261     1.084     0.0000
0 25  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    6.5451E-07 3.1195E-04 0.1575    0.3184
     0.4802    0.6471    0.7888    0.9101    1.011     1.091     1.148     259.2     395.2     475.3
     511.2     505.6     434.1     267.1     2.429     2.412     2.383     2.327     2.235     2.095
     1.918     1.703     1.454     1.187     0.9489    0.0000
0 26  0.0000    0.0000    0.0000    0.0000    2.2019E-07 1.1040E-04 3.4387E-04 0.1556    0.3066    0.4561
     0.6059    0.7524    0.8845    1.001     1.104     1.190     1.255     321.1     469.7     560.2
     617.0     632.3     581.3     470.7     304.9     2.504     2.500     2.468     2.377     2.223
     2.017     1.759     1.447     1.068     0.6567    0.0000
0 27  0.0000    0.0000    0.0000    0.0000    1.1022E-04 0.1104    0.1892    0.3089    0.4390    0.5739
     0.7133    0.8501    0.9786    1.097     1.202     1.293     1.366     373.1     550.7     661.0
     738.0     755.3     721.4     646.7     531.6     364.8     2.644     2.658     2.558     2.378
     2.144     1.855     1.491     0.9660    2.4944E-03 0.0000
0 28  0.0000    0.0000    0.0000    3.2236E-07 1.6157E-04 0.2520    0.3291    0.4346    0.5518    0.6755
     0.8069    0.9405    1.070     1.192     1.303     1.400     1.481     415.4     616.5     760.5
     843.8     869.1     855.5     801.7     712.3     571.5     354.9     2.931     2.780     2.560
     2.302     2.011     1.673     1.273     0.8436    0.0000
0 29  0.0000    0.0000    0.0000    1.6143E-04 0.1619    0.3151    0.4244    0.5301    0.6442    0.7650
     0.8927    1.025     1.158     1.285     1.402     1.506     1.595     454.1     677.9     836.4
     932.9     978.5     991.0     948.2     843.8     656.9     374.0     3.265     3.039     2.767
     2.484     2.196     1.897     1.589     1.312     0.0000
0 30  0.0000    0.0000    2.5353E-10 2.1602E-07 0.3319    0.4116    0.5033    0.6018    0.7126    0.8339
     0.9643    1.101     1.241     1.376     1.500     1.612     1.710     506.9     741.7     895.0
     1001.     1079.     1131.     1116.     993.5     738.2     4.255     3.748     3.326     2.971
     2.658     2.378     2.106     1.843     1.608     0.0000
0 31  0.0000    0.0000    3.8021E-08 2.1960E-05 0.4195    0.4760    0.5552    0.6481    0.7580    0.8835
     1.020     1.166     1.320     1.464     1.595     1.714     1.824     586.6     808.1     953.6
     1078.     1191.     1273.     1287.     1155.     859.2     4.528     4.114     3.533     3.111
     2.786     2.531     2.283     2.042     1.820     0.0000
0 32  0.0000    0.0000    1.6175E-05 1.6197E-02 137.8     177.9     173.7     170.0     184.6     217.6
     262.8     346.1     476.5     529.1     549.5     566.2     608.3     749.4     871.6     1014.
     1154.     1287.     1392.     1406.     1240.     949.2     5.000     4.620     183.5     158.8
     2.821     2.652     2.431     2.201     1.980     0.0000
0 33  0.0000    0.0000    2.6085E-05 2.6122E-02 193.0     250.7     250.3     243.7     259.7     304.3
     368.1     476.6     476.7     839.1     839.8     840.9     842.2     843.9     845.6     1048.
     1208.     1356.     1476.     1506.     1404.     1095.     5.578     334.8     269.4     192.9
     2.982     2.796     2.567     2.333     2.106     0.0000
0 34  0.0000    0.0000    2.4067E-05 2.4061E-02 192.0     260.3     269.4     252.8     254.8     304.9
     375.9     476.6     476.8     628.5     758.8     759.1     759.2     843.7     847.0     1058.
     1251.     1421.     1531.     1601.     1539.     1319.     891.1     470.7     4.039     3.722
     3.273     2.960     2.687     2.434     2.198     0.0000
0 35  0.0000    8.2314E-08 5.1288E-05 2.0184E-02 146.1     200.4     211.0     196.7     182.3     219.1
     302.7     476.5     476.8     628.2     758.8     759.0     759.2     759.4     848.2     1035.
     1280.     1523.     1523.     1667.     1641.     1453.     1047.     4.654     4.197     3.794
     3.398     3.059     2.766     2.500     2.257     0.0000
0 36  0.0000    3.1188E-05 3.1280E-02 0.1249    0.2515    0.3926    0.5440    0.7040    0.8730    1.049
     1.244     1.478     627.3     627.9     758.6     758.8     759.1     759.3     849.2     850.1
     1256.     1492.     1625.     1743.     1729.     1562.     1172.     4.722     4.244     3.815
     3.433     3.096     2.798     2.528     2.281     0.0000
0 37  0.0000    1.4431E-07 1.1341E-04 8.2575E-02 0.1994    0.3365    0.4882    0.6544    0.8315    0.9941
     1.157     273.9     551.0     757.7     758.2     758.6     759.0     759.4     927.7     1020.
     1284.     1504.     1680.     1805.     1804.     1674.     1390.     888.9     4.179     3.745
     3.392     3.073     2.780     2.512     2.266     0.0000
0 38  0.0000    0.0000    3.0644E-07 1.9364E-04 0.1118    0.2463    0.3974    0.5724    0.7850    0.9207
     189.5     318.9     433.1     545.8     757.9     758.3     758.8     927.3     927.6     928.4
     1273.     1514.     1718.     1839.     1853.     1761.     1550.     1199.     705.8     3.566
     3.280     2.986     2.712     2.456     2.216     0.0000
0 39  0.0000    0.0000    0.0000    4.3120E-07 2.3843E-04 0.1275    0.2633    0.4325    91.47     170.0
     242.9     273.0     235.6     1.882     6.649     6.831     926.1     927.1     927.8     928.4
     1276.     1515.     1723.     1841.     1868.     1807.     1629.     1328.     886.6     3.510
     3.151     2.868     2.609     2.366     2.136     0.0000
0 40  0.0000    0.0000    0.0000    0.0000    4.5213E-07 2.1461E-04 8.7905E-02 8.6237E-02 0.1359    168.2
     215.2     174.2     1.601     1.751     6.317     6.667     683.8     854.7     928.0     1090.
     1311.     1514.     1696.     1810.     1845.     1803.     1643.     1374.     1015.     550.5
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     2.928     2.701     2.465     2.241     2.032     0.0000
0 41  0.0000     0.0000     0.0000     0.0000     0.0000     3.3020E-07  1.1625E-04  2.8796E-02  1.9696E-02   117.2
     131.9     1.140     1.381     4.846     5.625     342.5     666.8     849.6     981.6     1139.
     1320.     1491.     1647.     1751.     1781.     1744.     1595     1352.     1063.     680.8
     2.821     2.523     2.291     2.082     1.910     0.0000
0 42  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.4469E-07  2.8730E-05  1.9668E-05  1.4448E-02
     0.5255     0.8427     3.201     4.046     155.9     361.4     649.8     840.6     984.1     1139.
     1292.     1438.     1586.     1678.     1689.     1633.     1497.     1298.     1065.     774.9
     404.9     2.268     2.078     1.867     1.800     0.0000
0 43  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     2.0954E-07  1.9029E-04
     0.1766     1.444     2.335     49.31     0.8888     1.054     536.5     768.8     932.2     1083.
     1222.     1349.     1458.     1524.     1523.     1471.     1361     1204.     1012.     779.0
     486.4     2.127     1.859     1.677     0.0000     0.0000
0 44  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     9.0002E-07
     7.1153E-04  0.5372     0.1318     0.4470     0.6783     0.3055     430.6     646.9     811.6     967.8
     1107.     1216.     1298.     1341.     1331.     1280.     1187     1055.     898.7     699.2
     483.2     234.1     1.539     1.458     0.0000     0.0000
0 45  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     1.6574E-04  0.1655     0.1241     0.1932     7.7318E-03  0.2175     287.1     448.1     590.3     783.1
     942.6     1043.     1108.     1133.     1108.     1047.     964.0     850.1     708.8     510.0
     350.4     197.1     1.252     1.292     0.0000     0.0000
0 46  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     3.3023E-07  1.6515E-04  1.2414E-04  1.9288E-04  7.7614E-05  6.9810E-02  5.7685E-02  7.8606E-02  0.1980     481.8
     706.6     816.8     869.9     877.2     825.6     716.6     641.0     550.0     405.7     0.9490
     0.8482     0.8729     1.012     0.0000     0.0000     0.0000
0 47  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     1.4698E-07  6.9665E-05  5.7665E-05  7.8703E-05  2.6685E-04  6.9527E-02
     386.7     512.7     555.5     546.5     448.6     0.7995     0.7964     0.7960     0.7782     0.7857
     0.7818     0.7880     0.0000     0.0000     0.0000     0.0000
0 48  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     3.6433E-07  9.8213E-05
     2.9072E-02  9.3986E-02  0.1072     0.1052     0.3116     0.5746     0.6682     0.7002     0.7061     0.7105
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0 49  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.2704E-07
     2.9080E-05  9.3852E-05  1.0706E-04  1.0532E-04  3.1116E-04  0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0 50  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0HEAD PRINT FORMAT IS FORMAT NUMBER  0   DRAWDOWN PRINT FORMAT IS FORMAT NUMBER  0
0HEADS WILL BE SAVED ON UNIT 30   DRAWDOWNS WILL BE SAVED ON UNIT 40
0OUTPUT CONTROL IS SPECIFIED EVERY TIME STEP
0                                   COLUMN TO ROW ANISOTROPY =   1.000000
0                                              DELR =   2000.000
0                                              DELC =   2000.000
0


                    HYD. COND. ALONG ROWS FOR LAYER  1 WILL BE READ ON UNIT 11 USING FORMAT: (10E12.4)
                    ----------------------------------------------------------------------------------

        1        2        3        4        5        6        7        8        9       10
       11       12       13       14       15       16       17       18       19       20
       21       22       23       24       25       26       27       28       29       30
       31       32       33       34       35       36
 ..................................................................................
0 1   1000.     1000.     1000.     1000.     1000.     1000.     1000.     1000.     1000.     1000.
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      1000.   1000.   1000.   1000    1000.   1000.
0 42  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 43  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 44  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 45  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 46  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 47  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 48  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 49  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0 50  1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.   1000.   1000.   1000.   1000.
      1000.   1000.   1000.   1000    1000.   1000.
0                                BOTTOM =  -400.0000    FOR LAYER  1
0
```

SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE

0 MAXIMUM ITERATIONS ALLOWED FOR CLOSURE = 25000
ACCELERATION PARAMETER = 1.0000
HEAD CHANGE CRITERION FOR CLOSURE = 0.10000E-02
SIP HEAD CHANGE PRINTOUT INTERVAL = 1
0 CALCULATE ITERATION PARAMETERS FROM MODEL CALCULATED WSEED

HORIZONTAL FLOW BARRIERS – LISTED BY LAYERS. WITHIN EACH LAYER, THE LOCATION OF A BARRIER IS IDENTIFIED BY THE 2 CELLS ON BOTH SIDES OF THE BARRIER. THE ROW AND COLUMN NUMBER OF THE TWO CELLS ARE RESPECTIVELY IROW1, ICOL1, AND IROW2, ICOL2.

0 895 HORIZONTAL FLOW BARRIERS IN LAYER 1

IROW1	ICOL1	IROW2	ICOL2	HYD. COND./WIDTH	BARRIER NO.
33	30	33	31	0.5010E-04	1
33	29	33	30	0.5010E-04	2
38	29	38	30	0.5010E-04	3
33	29	34	29	0.5010E-04	4
37	29	38	29	0.5010E-04	5
33	28	34	28	0.5010E-04	6
28	27	28	28	0.5010E-04	7
28	27	29	27	0.5010E-04	8
29	26	29	27	0.5010E-04	9
34	26	34	27	0.5010E-04	10
29	26	30	26	0.5010E-04	11
34	26	35	26	0.5010E-04	12
30	25	30	26	0.5010E-04	13
31	25	31	26	0.5010E-04	14
32	25	32	26	0.5010E-04	15
35	25	35	26	0.5010E-04	16
41	25	41	26	0.5010E-04	17
42	25	42	26	0.5010E-04	18
47	25	47	26	0.5010E-04	19
32	24	32	25	0.5010E-04	20
33	24	33	25	0.5010E-04	21
37	23	37	24	0.5010E-04	22
40	23	40	24	0.5010E-04	23
37	23	38	23	0.5010E-04	24
40	23	41	23	0.5010E-04	25
45	21	45	22	0.5010E-04	26
48	21	48	22	0.5010E-04	27
46	18	46	19	0.5010E-04	28
46	17	46	18	0.5010E-04	29
45	16	45	17	0.5010E-04	30
45	15	45	16	0.5010E-04	31
40	17	41	17	0.5010E-04	32
41	16	41	17	0.5010E-04	33
41	16	42	16	0.5010E-04	34
42	15	42	16	0.5010E-04	35
42	15	43	15	0.5010E-04	36
43	14	43	15	0.5010E-04	37
43	14	44	14	0.5010E-04	38
44	13	44	14	0.5010E-04	39
14	13	15	13	0.5010E-04	40
10	12	11	12	0.5010E-04	41
11	12	12	12	0.5010E-04	42
9	11	10	11	0.5010E-04	43
41	10	42	10	0.5010E-04	44
42	9	42	10	0.5010E-04	45
40	9	41	9	0.5010E-04	46
41	8	41	9	0.5010E-04	47
39	8	40	8	0.5010E-04	48
40	7	40	8	0.5010E-04	49
41	13	42	13	0.5010E-04	50
42	12	42	13	0.5010E-04	51
42	12	43	12	0.5010E-04	52
39	11	40	11	0.5010E-04	53
40	10	40	11	0.5010E-04	54
40	10	41	10	0.5010E-04	55
40	25	41	25	0.5010E-04	56
42	26	43	26	0.5010E-04	57
38	22	38	23	0.5010E-04	58
35	4	36	4	0.5010E-04	59
34	4	35	4	0.5010E-04	60
33	4	34	4	0.5010E-04	61
32	4	33	4	0.5010E-04	62
31	4	32	4	0.5010E-04	63
31	5	32	5	0.5010E-04	64
31	6	32	6	0.5010E-04	65
31	7	32	7	0.5010E-04	66
31	8	32	8	0.5010E-04	67
31	9	32	9	0.5010E-04	68
31	10	32	10	0.5010E-04	69
31	11	32	11	0.5010E-04	70
31	12	32	12	0.5010E-04	71

31	13	32	13	0.5010E-04	72
31	14	32	14	0.5010E-04	73
31	15	32	15	0.5010E-04	74
31	16	32	16	0.5010E-04	75
31	17	32	17	0.5010E-04	76
32	4	32	5	0.5010E-04	77
32	5	32	6	0.5010E-04	78
32	6	32	7	0.5010E-04	79
32	7	32	8	0.5010E-04	80
32	8	32	9	0.5010E-04	81
32	9	32	10	0.5010E-04	82
32	10	32	11	0.5010E-04	83
32	11	32	12	0.5010E-04	84
32	12	32	13	0.5010E-04	85
32	13	32	14	0.5010E-04	86
32	14	32	15	0.5010E-04	87
32	15	32	16	0.5010E-04	88
32	16	32	17	0.5010E-04	89
32	17	32	18	0.5010E-04	90
32	5	33	5	0.5010E-04	91
32	6	33	6	0.5010E-04	92
32	7	33	7	0.5010E-04	93
32	8	33	8	0.5010E-04	94
32	9	33	9	0.5010E-04	95
32	10	33	10	0.5010E-04	96
32	11	33	11	0.5010E-04	97
32	12	33	12	0.5010E-04	98
33	4	33	5	0.5010E-04	99
33	5	33	6	0.5010E-04	100
33	6	33	7	0.5010E-04	101
33	7	33	8	0.5010E-04	102
33	8	33	9	0.5010E-04	103
33	9	33	10	0.5010E-04	104
33	10	33	11	0.5010E-04	105
33	11	33	12	0.5010E-04	106
33	5	34	5	0.5010E-04	107
33	6	34	6	0.5010E-04	108
33	7	34	7	0.5010E-04	109
33	8	34	8	0.5010E-04	110
33	9	34	9	0.5010E-04	111
33	10	34	10	0.5010E-04	112
33	11	34	11	0.5010E-04	113
34	4	34	5	0.5010E-04	114
34	5	34	6	0.5010E-04	115
34	6	34	7	0.5010E-04	116
34	7	34	8	0.5010E-04	117
34	8	34	9	0.5010E-04	118
34	9	34	10	0.5010E-04	119
34	10	34	11	0.5010E-04	120
34	11	34	12	0.5010E-04	121
34	5	35	5	0.5010E-04	122
34	6	35	6	0.5010E-04	123
34	7	35	7	0.5010E-04	124
34	8	35	8	0.5010E-04	125
34	9	35	9	0.5010E-04	126
34	10	35	10	0.5010E-04	127
34	11	35	11	0.5010E-04	128
35	4	35	5	0.5010E-04	129
35	5	35	6	0.5010E-04	130
35	6	35	7	0.5010E-04	131
35	7	35	8	0.5010E-04	132
35	8	35	9	0.5010E-04	133
35	9	35	10	0.5010E-04	134
35	10	35	11	0.5010E-04	135
35	11	35	12	0.5010E-04	136
35	5	36	5	0.5010E-04	137
35	6	36	6	0.5010E-04	138
35	7	36	7	0.5010E-04	139
35	8	36	8	0.5010E-04	140
35	9	36	9	0.5010E-04	141
35	10	36	10	0.5010E-04	142
35	11	36	11	0.5010E-04	143
35	12	36	12	0.5010E-04	144
35	13	36	13	0.5010E-04	145
36	12	36	13	0.5010E-04	146
36	12	37	12	0.5010E-04	147
36	13	37	13	0.5010E-04	148
37	11	37	12	0.5010E-04	149
37	12	37	13	0.5010E-04	150
37	11	38	11	0.5010E-04	151
37	12	38	12	0.5010E-04	152
37	13	38	13	0.5010E-04	153
38	10	38	11	0.5010E-04	154
38	11	38	12	0.5010E-04	155
38	12	38	13	0.5010E-04	156
38	9	39	9	0.5010E-04	157
38	10	39	10	0.5010E-04	158

38	11	39	11	0.5010E-04	159
38	12	39	12	0.5010E-04	160
38	13	39	13	0.5010E-04	161
38	14	39	14	0.5010E-04	162
38	15	39	15	0.5010E-04	163
38	16	39	16	0.5010E-04	164
39	8	39	9	0 5010E-04	165
39	9	39	10	0 5010E-04	166
39	10	39	11	0 5010E-04	167
39	11	39	12	0.5010E-04	168
39	12	39	13	0 5010E-04	169
39	13	39	14	0.5010E-04	170
39	14	39	15	0.5010E-04	171
39	16	39	17	0.5010E-04	172
39	9	40	9	0.5010E-04	173
39	10	40	10	0.5010E-04	174
39	12	40	12	0.5010E-04	175
39	13	40	13	0.5010E-04	176
40	9	40	10	0.5010E-04	177
40	11	40	12	0.5010E-04	178
40	12	40	13	0.5010E-04	179
40	11	41	11	0.5010E-04	180
40	12	41	12	0.5010E-04	181
41	9	41	10	0.5010E-04	182
41	10	41	11	0.5010E-04	183
41	11	41	12	0.5010E-04	184
41	11	42	11	0.5010E-04	185
42	10	42	11	0.5010E-04	186
39	17	40	17	0.5010E-04	187
43	11	43	12	0.5010E-04	188
41	13	41	14	0.5010E-04	189
40	14	41	14	0.5010E-04	190
40	14	40	15	0.5010E-04	191
44	12	44	13	0.5010E-04	192
43	13	44	13	0.5010E-04	193
43	13	43	14	0.5010E-04	194
42	14	43	14	0.5010E-04	195
42	14	42	15	0.5010E-04	196
41	15	42	15	0.5010E-04	197
41	15	41	16	0.5010E-04	198
40	16	41	16	0.5010E-04	199
40	16	40	17	0.5010E-04	200
45	14	45	15	0.5010E-04	201
44	15	45	15	0.5010E-04	202
44	15	44	16	0.5010E-04	203
43	16	44	16	0.5010E-04	204
43	16	43	17	0.5010E-04	205
42	16	43	16	0.5010E-04	206
42	16	42	17	0.5010E-04	207
41	17	42	17	0.5010E-04	208
41	17	41	18	0.5010E-04	209
40	17	40	18	0.5010E-04	210
40	18	41	18	0.5010E-04	211
40	18	40	19	0.5010E-04	212
40	19	40	20	0.5010E-04	213
40	20	40	21	0.5010E-04	214
40	21	40	22	0.5010E-04	215
40	22	40	23	0.5010E-04	216
40	24	40	25	0.5010E-04	217
40	25	40	26	0.5010E-04	218
40	26	40	27	0.5010E-04	219
40	19	41	19	0.5010E-04	220
40	20	41	20	0.5010E-04	221
40	21	41	21	0.5010E-04	222
40	22	41	22	0.5010E-04	223
40	24	41	24	0.5010E-04	224
40	26	41	26	0.5010E-04	225
41	18	41	19	0.5010E-04	226
41	19	41	20	0.5010E-04	227
41	20	41	21	0.5010E-04	228
41	21	41	22	0.5010E-04	229
41	22	41	23	0.5010E-04	230
41	23	41	24	0.5010E-04	231
41	24	41	25	0.5010E-04	232
41	26	41	27	0.5010E-04	233
41	18	42	18	0.5010E-04	234
41	19	42	19	0.5010E-04	235
41	20	42	20	0.5010E-04	236
41	21	42	21	0.5010E-04	237
41	22	42	22	0.5010E-04	238
41	23	42	23	0.5010E-04	239
41	25	42	25	0.5010E-04	240
41	26	42	26	0.5010E-04	241
42	17	42	18	0.5010E-04	242
42	18	42	19	0.5010E-04	243
42	19	42	20	0.5010E-04	244
42	20	42	21	0.5010E-04	245

42	21	42	22	0.5010E-04	246
42	22	42	23	0.5010E-04	247
42	23	42	24	0.5010E-04	248
42	24	42	25	0.5010E-04	249
42	26	42	27	0.5010E-04	250
42	18	43	18	0.5010E-04	251
42	19	43	19	0.5010E-04	252
42	20	43	20	0.5010E-04	253
42	21	43	21	0.5010E-04	254
42	22	43	22	0.5010E-04	255
42	25	43	25	0.5010E-04	256
42	27	43	27	0.5010E-04	257
43	17	43	18	0.5010E-04	258
43	18	43	19	0.5010E-04	259
43	19	43	20	0.5010E-04	260
43	20	43	21	0.5010E-04	261
43	21	43	22	0.5010E-04	262
43	22	43	23	0.5010E-04	263
43	23	43	24	0.5010E-04	264
43	24	43	25	0.5010E-04	265
43	25	43	26	0.5010E-04	266
43	26	43	27	0.5010E-04	267
43	27	43	28	0.5010E-04	268
43	17	44	17	0.5010E-04	269
43	18	44	18	0.5010E-04	270
43	19	44	19	0.5010E-04	271
43	20	44	20	0.5010E-04	272
43	21	44	21	0.5010E-04	273
43	22	44	22	0.5010E-04	274
43	24	44	24	0.5010E-04	275
43	25	44	25	0.5010E-04	276
43	26	44	26	0.5010E-04	277
44	16	44	17	0.5010E-04	278
44	17	44	18	0.5010E-04	279
44	18	44	19	0.5010E-04	280
44	19	44	20	0.5010E-04	281
44	20	44	21	0.5010E-04	282
44	21	44	22	0.5010E-04	283
44	22	44	23	0.5010E-04	284
44	24	44	25	0.5010E-04	285
44	25	44	26	0.5010E-04	286
44	26	44	27	0.5010E-04	287
44	27	44	28	0.5010E-04	288
44	19	45	19	0.5010E-04	289
44	20	45	20	0.5010E-04	290
44	21	45	21	0.5010E-04	291
44	22	45	22	0.5010E-04	292
44	25	45	25	0.5010E-04	293
44	26	45	26	0.5010E-04	294
44	27	45	27	0.5010E-04	295
44	28	45	28	0.5010E-04	296
45	17	45	18	0.5010E-04	297
45	18	45	19	0.5010E-04	298
45	19	45	20	0.5010E-04	299
45	20	45	21	0.5010E-04	300
45	22	45	23	0.5010E-04	301
45	24	45	25	0.5010E-04	302
45	25	45	26	0.5010E-04	303
45	26	45	27	0.5010E-04	304
45	29	45	30	0.5010E-04	305
45	21	46	21	0.5010E-04	306
45	22	46	22	0.5010E-04	307
45	25	46	25	0.5010E-04	308
45	26	46	26	0.5010E-04	309
46	19	46	20	0.5010E-04	310
46	20	46	21	0.5010E-04	311
46	21	46	22	0.5010E-04	312
46	22	46	23	0.5010E-04	313
46	24	46	25	0.5010E-04	314
46	25	46	26	0.5010E-04	315
46	26	46	27	0.5010E-04	316
46	29	46	30	0.5010E-04	317
46	21	47	21	0.5010E-04	318
46	22	47	22	0.5010E-04	319
46	25	47	25	0.5010E-04	320
46	26	47	26	0.5010E-04	321
47	20	47	21	0.5010E-04	322
47	21	47	22	0.5010E-04	323
47	22	47	23	0.5010E-04	324
47	24	47	25	0.5010E-04	325
47	26	47	27	0.5010E-04	326
47	21	48	21	0.5010E-04	327
47	22	48	22	0.5010E-04	328
47	25	48	25	0.5010E-04	329
48	22	48	23	0.5010E-04	330
39	20	40	20	0.5010E-04	331
39	21	40	21	0.5010E-04	332

39	22	40	22	0.5010E-04	333
39	23	40	23	0.5010E-04	334
39	24	40	24	0.5010E-04	335
39	25	40	25	0.5010E-04	336
39	26	40	26	0.5010E-04	337
39	20	39	21	0.5010E-04	338
39	21	39	22	0.5010E-04	339
39	22	39	23	0.5010E-04	340
39	23	39	24	0.5010E-04	341
39	24	39	25	0.5010E-04	342
39	25	39	26	0.5010E-04	343
39	26	39	27	0.5010E-04	344
39	29	39	30	0.5010E-04	345
39	30	40	30	0.5010E-04	346
40	30	40	31	0.5010E-04	347
41	30	41	31	0.5010E-04	348
41	31	42	31	0.5010E-04	349
42	31	42	32	0.5010E-04	350
43	31	43	32	0.5010E-04	351
43	32	44	32	0.5010E-04	352
44	32	44	33	0.5010E-04	353
45	32	45	33	0.5010E-04	354
38	21	39	21	0.5010E-04	355
38	22	39	22	0.5010E-04	356
38	23	39	23	0.5010E-04	357
38	24	39	24	0.5010E-04	358
38	25	39	25	0.5010E-04	359
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46	23	47	23	0.5010E-04	785
46	24	47	24	0.5010E-04	786
46	27	47	27	0.5010E-04	787
46	28	47	28	0.5010E-04	788
46	29	47	29	0.5010E-04	789
47	23	48	23	0.5010E-04	790
47	24	48	24	0.5010E-04	791
37	27	37	28	0.5010E-04	792
38	27	38	28	0.5010E-04	793
38	28	38	29	0.5010E-04	794
39	27	39	28	0.5010E-04	795
39	28	39	29	0.5010E-04	796
40	27	40	28	0.5010E-04	797
40	28	40	29	0.5010E-04	798
40	29	40	30	0.5010E-04	799
41	27	41	28	0.5010E-04	800
41	28	41	29	0.5010E-04	801
41	29	41	30	0.5010E-04	802
42	27	42	28	0.5010E-04	803
42	28	42	29	0.5010E-04	804
42	29	42	30	0.5010E-04	805
42	30	42	31	0.5010E-04	806
43	28	43	29	0.5010E-04	807
43	29	43	30	0.5010E-04	808
43	30	43	31	0.5010E-04	809
44	23	44	24	0.5010E-04	810
44	28	44	29	0.5010E-04	811
44	29	44	30	0.5010E-04	812
44	30	44	31	0.5010E-04	813
44	31	44	32	0.5010E-04	814
45	23	45	24	0.5010E-04	815
45	27	45	28	0.5010E-04	816
45	28	45	29	0.5010E-04	817
45	30	45	31	0.5010E-04	818
45	31	45	32	0.5010E-04	819
46	23	46	24	0.5010E-04	820
46	27	46	28	0.5010E-04	821
46	28	46	29	0.5010E-04	822
46	30	46	31	0.5010E-04	823
46	31	46	32	0.5010E-04	824
47	23	47	24	0.5010E-04	825
47	27	47	28	0.5010E-04	826
47	28	47	29	0.5010E-04	827
48	24	48	25	0.5010E-04	828
33	30	34	30	0.5010E-04	829
33	13	33	14	0.5010E-04	830
34	13	34	14	0.5010E-04	831
35	13	35	14	0.5010E-04	832
37	13	37	14	0.5010E-04	833
38	13	38	14	0.5010E-04	834
36	14	36	15	0.5010E-04	835
35	14	35	15	0.5010E-04	836
34	14	34	15	0.5010E-04	837
33	15	34	15	0.5010E-04	838
33	16	34	16	0.5010E-04	839
33	17	34	17	0.5010E-04	840
34	17	34	18	0.5010E-04	841
34	18	35	18	0.5010E-04	842
34	18	34	19	0.5010E-04	843
35	18	35	19	0.5010E-04	844
36	18	36	19	0.5010E-04	845
37	18	37	19	0.5010E-04	846
37	18	38	18	0.5010E-04	847
38	17	38	18	0.5010E-04	848
38	17	39	17	0.5010E-04	849
32	15	33	15	0.5010E-04	850
32	16	33	16	0.5010E-04	851
32	17	33	17	0.5010E-04	852
32	18	33	18	0.5010E-04	853
32	19	33	19	0.5010E-04	854

33	19	33	20	0.5010E-04	855
34	19	34	20	0.5010E-04	856
35	19	35	20	0.5010E-04	857
39	18	40	18	0.5010E-04	858
37	19	37	20	0.5010E-04	859
37	20	38	20	0.5010E-04	860
36	19	37	19	0.5010E-04	861
37	14	38	14	0.5010E-04	862
38	14	38	15	0.5010E-04	863
8	14	9	14	0.5010E-04	864
7	11	8	11	0.5010E-04	865
33	14	34	14	0.5010E-04	866
36	14	37	14	0.5010E-04	867
45	14	45	15	0.5010E-04	868
16	13	17	13	0.5010E-04	869
16	14	17	14	0.5010E-04	870
31	4	31	5	0.5010E-04	871
30	4	30	5	0.5010E-04	872
28	5	28	6	0.5010E-04	873
23	11	23	12	0.5010E-04	874
23	23	24	23	0.5010E-04	875
24	23	24	24	0.5010E-04	876
24	23	25	23	0.5010E-04	877
24	24	25	24	0.5010E-04	878
25	23	25	24	0.5010E-04	879
25	24	25	25	0.5010E-04	880
25	23	26	23	0.5010E-04	881
25	24	26	24	0.5010E-04	882
25	25	26	25	0.5010E-04	883
26	23	26	24	0.5010E-04	884
26	24	26	25	0.5010E-04	885
26	25	26	26	0.5010E-04	886
26	23	27	23	0.5010E-04	887
26	24	27	24	0.5010E-04	888
26	25	27	25	0.5010E-04	889
26	26	27	26	0.5010E-04	890
27	23	27	24	0.5010E-04	891
27	24	27	25	0.5010E-04	892
27	25	27	26	0.5010E-04	893
27	26	27	27	0.5010E-04	894
33	28	33	29	0.5010E-04	895

1 STRESS PERIOD NO. 1, LENGTH = 1.000000

NUMBER OF TIME STEPS = 1

MULTIPLIER FOR DELT = 1.000

INITIAL TIME STEP SIZE = 1.000000

0 22 WELLS

LAYER	ROW	COL	STRESS RATE	WELL NO.
1	44	16	0.00000	1
1	44	15	0.00000	2
1	43	13	0.00000	3
1	38	12	0.00000	4
1	39	23	0.00000	5
1	39	24	0.00000	6
1	38	34	0.00000	7
1	37	22	0.00000	8
1	36	23	0.00000	9
1	36	24	0.00000	10
1	35	22	0.00000	11
1	36	20	0.00000	12
1	33	19	0.00000	13
1	33	25	0.00000	14
1	32	25	0.00000	15
1	30	26	0.00000	16
1	30	23	0.00000	17
1	29	23	0.00000	18
1	27	22	0.00000	19
1	27	31	0.00000	20
1	31	22	0.00000	21
1	32	21	0.00000	22

0

3 DRAINS

0

LAYER	ROW	COL	ELEVATION	CONDUCTANCE	DRAIN NO.
1	32	25	1103.	255.8	1
1	33	25	1500.	1370.	2
1	33	24	1500.	1370.	3

0

RECHARGE WILL BE READ ON UNIT 18 USING FORMAT: (10E12.4)

```
        1       2       3       4       5       6       7       8       9      10
       11      12      13      14      15      16      17      18      19      20
       21      22      23      24      25      26      27      28      29      30
       31      32      33      34      35      36
 ..................................................................................
0 1  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 2  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  2.2830E-06 0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 3  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  3.3332E-04 1.4155E-03 1.6323E-03 9.9767E-04 5.7075E-04 4.5432E-04 4.5660E-06
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 4  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  4.1094E-05 5.0911E-04 1.7442E-03 1.9976E-03 1.9862E-03 1.9976E-03 1.9725E-03 1.8196E-03 1.7259E-03
     3.8583E-04 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 5  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  4.9998E-04 1.8926E-03 1.9406E-03 2.0159E-03 2.0935E-03 1.9223E-03 1.7739E-03 1.6118E-03 1.6712E-03
     1.7396E-03 7.4654E-04 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 6  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  1.1050E-03 1.9132E-03 1.9953E-03 1.9953E-03 1.8926E-03 1.6301E-03 1.7602E-03 1.5524E-03 1.5456E-03
     1.7670E-03 1.9931E-03 8.4243E-04 9.1320E-06 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 7  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  1.3607E-03 1.9611E-03 2.0159E-03 1.8150E-03 1.6483E-03 1.6483E-03 1.6871E-03 1.6575E-03 1.6209E-03
     1.7488E-03 1.9132E-03 2.0410E-03 1.1849E-03 1.5981E-04 0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 8  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     2.7396E-04 1.8561E-03 1.9908E-03 1.8629E-03 1.7419E-03 1.7511E-03 1.7488E-03 1.7328E-03 1.6757E-03 1.6483E-03
     1.9132E-03 1.7259E-03 1.9908E-03 1.7670E-03 1.1803E-03 2.6939E-04 0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 9  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     7.0773E-05 1.6552E-03 2.0912E-03 2.1049E-03 1.7670E-03 1.4931E-03 1.4908E-03 1.6757E-03 2.4702E-03 1.9200E-03
     1.8310E-03 1.6483E-03 1.7785E-03 1.7305E-03 1.5136E-03 1.3241E-03 2.3743E-04 0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 10 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  1.1712E-03 2.1437E-03 2.2647E-03 1.6986E-03 1.4292E-03 9.1777E-04 2.1760E-03 3.4839E-03 2.3035E-03
     1.7739E-03 1.8081E-03 1.8355E-03 1.7282E-03 1.5456E-03 1.5068E-03 7.6937E-04 0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 11 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  1.0342E-03 2.2442E-03 2.2693E-03 1.9748E-03 1.5593E-03 5.2509E-04 2.3401E-03 3.7875E-03 3.1072E-03
     1.6278E-03 1.3698E-03 1.7944E-03 1.6826E-03 1.7145E-03 1.5753E-03 1.1187E-03 5.7075E-05 0.0000  0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 12 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  4.5660E-06 1.7670E-03 2.3195E-03 2.1803E-03 2.2145E-03 3.1848E-03 3.9016E-03 2.0958E-03 2.4793E-03
     2.4725E-03 1.5776E-03 1.9154E-03 1.9360E-03 1.5913E-03 1.6552E-03 1.9794E-03 1.0342E-03 2.9679E-05 0.0000
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 13 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  1.1210E-03 2.3606E-03 2.2328E-03 2.5273E-03 3.1825E-03 4.2350E-03 2.3127E-03 8.1731E-04
     2.7990E-03 1.4725E-03 2.0068E-03 1.9154E-03 1.4406E-03 1.7830E-03 1.9794E-03 1.9588E-03 8.0590E-04 7.3056E-05
     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
0 14 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  3.0364E-04 2.3652E-03 2.2305E-03 2.4428E-03 3.5569E-03 4.9952E-03 2.8720E-03 1.9634E-03
     3.1871E-03 1.5981E-03 6.1184E-04 1.2214E-03 1.8378E-03 1.5342E-03 1.8515E-03 2.1506E-03 2.0501E-03 9.3831E-04
     2.7396E-05 0.0000  0.0000  0.0000  0.0000  0.0000
0 15 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  6.8490E-06 2.1597E-03 2.3104E-03 2.4953E-03 3.5364E-03 4.8514E-03 1.3241E-03 1.6323E-03
     3.6345E-03 1.4223E-03 1.7807E-04 8.6069E-04 1.5684E-03 1.4862E-03 1.8789E-03 2.6780E-03 2.5684E-03 1.9086E-03
     1.2511E-03 7.0773E-05 0.0000  0.0000  0.0000  0.0000
0 16 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  1.8698E-03 2.5227E-03 2.5981E-03 4.0683E-03 5.1824E-03 4.3445E-03 3.9268E-04
     9.6799E-04 5.3651E-04 4.2007E-04 5.5249E-04 1.7396E-03 1.7944E-03 2.1186E-03 2.5159E-03 2.0182E-03 1.9816E-03
     1.8036E-03 9.4516E-04 0.0000  0.0000  0.0000  0.0000
0 17 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  0.0000  1.8652E-03 2.3994E-03 2.7693E-03 4.5500E-03 5.1550E-03 3.9222E-03 2.6483E-04
     8.1275E-04 3.6368E-03 3.1163E-03 4.7258E-04 1.7465E-03 1.3744E-03 1.8903E-03 2.1757E-03 1.8606E-03 1.9976E-03
     1.8835E-03 1.7465E-03 3.2419E-04 0.0000  0.0000  0.0000
0 18 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  1.3470E-04 2.2099E-03 2.0090E-03 2.5821E-03 4.8833E-03 5.2075E-03 3.6642E-03 1.0274E-04
     8.8352E-04 1.3287E-03 1.8721E-03 1.3241E-03 1.3949E-03 4.3834E-04 2.3172E-03 1.2054E-03 1.5410E-03 1.9976E-03
     1.9748E-03 1.8127E-03 1.5182E-03 1.3013E-04 0.0000  0.0000
0 19 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  5.2966E-04 2.3264E-03 2.1004E-03 2.7716E-03 4.4610E-03 5.1870E-03 3.1505E-03 6.6207E-05
     9.4060E-04 4.1048E-03 1.4474E-03 1.9634E-03 4.0637E-04 1.3812E-03 1.5250E-03 3.9953E-04 7.3056E-04 1.6552E-03
     2.0661E-03 1.9520E-03 1.8127E-03 1.0662E-03 0.0000  0.0000
0 20 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
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     3.5843E-04 3.2282E-03 7.7165E-04 1.4132E-03 1.8538E-03 1.6186E-03 1.3264E-03 9.1777E-04 8.3101E-04 1.8036E-03
     2.0981E-03 1.9314E-03 1.8059E-03 1.7533E-03 2.6483E-04 0.0000
0 21 0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
     0.0000  0.0000  1.8995E-03 2.4474E-03 1.4040E-03 1.0844E-03 8.0618E-04 4.2327E-03 4.2761E-03 3.2898E-03
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8.3101E-04 1.1598E-03 3.7898E-04 2.2853E-03 1.6689E-03 1.1210E-03 1.9953E-03 1.6620E-03 9.6571E-04 1.2899E-03
1.4132E-03 1.8469E-03 1.6986E-03 1.7145E-03 5.7532E-04 0.0000
0 22 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 2.6255E-04 2.3081E-03 2.2077E-03 1.5890E-03 1.4337E-03 1.2305E-03 2.9428E-03 2.7305E-03 6.7805E-04
2.6483E-04 1.3470E-03 2.1049E-03 1.6164E-03 3.2350E-03 1.2374E-03 9.3831E-04 5.5249E-04 3.9496E-04 7.5339E-04
1.4063E-03 1.7328E-03 1.5273E-03 1.6346E-03 1.0639E-03 0.0000
0 23 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
2.2830E-05 1.4520E-03 2.4086E-03 2.3743E-03 1.4451E-03 3.3560E-04 4.5888E-04 9.8169E-05 0.0000 0.0000
3.0821E-04 7.7394E-04 1.6666E-03 1.7305E-03 1.1004E-03 3.4017E-04 7.3284E-04 2.5570E-04 1.1643E-04 3.1505E-04
1.6460E-03 1.6826E-03 1.7054E-03 1.7031E-03 1.3264E-03 2.2830E-05
0 24 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 2.0319E-04
1.3333E-03 2.2944E-03 2.2351E-03 1.8675E-03 1.6323E-03 1.3356E-03 2.1689E-04 2.7396E-05 0.0000 0.0000
3.4017E-04 7.2828E-04 1.9565E-03 3.3332E-04 5.2052E-04 1.1643E-04 2.7396E-05 6.1641E-05 5.0226E-05 3.0364E-04
1.5913E-03 1.8698E-03 1.7556E-03 1.7830E-03 6.5294E-04 2.7396E-05
0 25 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 4.3377E-04 1.7282E-03
2.1072E-03 1.9976E-03 1.5616E-03 1.8652E-03 1.5319E-03 1.6323E-03 1.1210E-03 3.2647E-04 4.5660E-06 1.6209E-04
1.4383E-04 8.1731E-04 1.3127E-03 2.9679E-05 1.5981E-04 2.7396E-04 1.5319E-03 1.1940E-03 2.6460E-03 1.6986E-03
1.6552E-03 1.8196E-03 1.6620E-03 1.6209E-03 1.3538E-03 1.1415E-04
0 26 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 2.0547E-05 6.1869E-04 1.8104E-03 1.9428E-03
2.1552E-03 2.2122E-03 1.7374E-03 8.3101E-04 1.1073E-03 1.7100E-03 1.4223E-03 1.6346E-03 5.9358E-04 6.6207E-05
3.0364E-04 1.3881E-03 9.3603E-04 4.0181E-04 4.6802E-04 3.1962E-05 2.8994E-04 8.5613E-04 2.5364E-03 2.2693E-03
2.5775E-03 1.5205E-03 1.6164E-03 1.5958E-03 1.5205E-03 6.3924E-05
0 27 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 8.0818E-04 1.7168E-03 1.4862E-03 1.1529E-03
1.6506E-03 1.5365E-03 1.3401E-03 1.2945E-03 1.3356E-03 1.4954E-03 1.5639E-03 1.7648E-03 1.2785E-03 4.4062E-04
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1.9885E-03 1.0547E-03 7.2371E-04 6.1869E-04 1.8310E-03 3.3332E-03 5.1641E-03 3.9016E-03 3.3994E-03 1.0365E-03
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2.1004E-03 1.1278E-03 1.2693E-03 5.6847E-04 9.3146E-04 1.0365E-03 4.8011E-03 2.3606E-03 1.7100E-03 1.4200E-03
1.1392E-03 1.4908E-03 2.3172E-03 3.1209E-03 2.6780E-03 7.0773E-05
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3.2190E-04 1.8036E-04 1.9246E-03 3.1094E-03 2.6095E-03 4.6847E-03 4.0135E-03 2.8766E-03 1.2945E-03 2.1643E-03
1.4292E-03 2.1437E-03 2.4839E-03 2.5022E-03 1.0022E-03 9.1320E-05
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1.0159E-03 9.1777E-04 1.1324E-03 1.4200E-03 1.4794E-03 1.6415E-03 1.4680E-03 1.6141E-03 1.4063E-03 8.9037E-05
0.0000 1.3401E-03 3.3514E-03 7.5134E-03 7.6389E-03 8.0773E-03 3.8811E-03 2.7853E-03 2.4862E-03 2.4839E-03
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8.5613E-04 1.1255E-03 1.0707E-03 1.0844E-03 1.3949E-03 1.4383E-03 1.3515E-03 1.6346E-03 1.7054E-03 4.2692E-04
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2.4885E-03 2.7259E-03 2.1186E-03 1.7990E-03 1.1141E-03 9.3603E-05
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2.6939E-04 7.7850E-04 5.3148E-03 8.3535E-03 8.7439E-03 9.3398E-03 9.1297E-03 7.8284E-03 4.9724E-03 4.0135E-03
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7.3741E-04 1.1164E-03 8.3330E-04 7.7622E-04 6.3696E-04 8.6297E-04 9.0407E-04 1.6689E-03 1.9565E-03 8.5384E-04
6.9175E-04 2.3971E-04 4.8080E-03 7.7188E-03 8.3718E-03 8.9631E-03 8.7599E-03 6.2440E-03 4.9176E-03 3.7464E-03
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5.7075E-04 1.0159E-03 1.1187E-03 8.0133E-04 7.4426E-04 1.2990E-03 1.6597E-03 1.7693E-03 1.8081E-03 2.0935E-03
2.0638E-03 1.8104E-03 2.6232E-03 7.6503E-03 8.2576E-03 8.2622E-03 7.1823E-03 7.6092E-03 6.4129E-03 4.2943E-03
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0 37 0.0000 0.0000 0.0000 5.6162E-04 1.5250E-03 1.9588E-03 2.0387E-03 2.1392E-03 1.9520E-03 1.7899E-03
1.6849E-03 9.2005E-04 9.2462E-04 6.6664E-04 9.1777E-04 1.2283E-03 1.5273E-03 1.7168E-03 1.7328E-03 1.7944E-03
1.9542E-03 1.3104E-03 2.8469E-03 8.1983E-03 8.2736E-03 7.7622E-03 7.2805E-03 6.9814E-03 5.1938E-03 2.8378E-03
3.8080E-03 3.5912E-03 2.5821E-03 1.8378E-03 1.3378E-03 1.3698E-04
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1.7282E-03 1.4885E-03 7.1001E-04 5.2509E-04 6.6207E-04 5.6618E-04 8.6526E-04 1.0456E-03 9.9995E-04 1.7716E-03
1.5981E-03 9.1548E-04 5.4335E-03 7.5659E-03 7.8581E-03 7.7668E-03 8.3307E-03 6.9791E-03 4.4153E-03 3.2921E-03
2.4360E-03 1.1575E-03 1.5753E-03 1.7100E-03 1.1598E-03 6.8490E-05
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1.8743E-03 1.8538E-03 1.8332E-03 9.4745E-04 6.0956E-04 5.1139E-04 6.5066E-04 8.8809E-04 1.0936E-03 1.2214E-03
8.5613E-04 4.7030E-04 5.6070E-03 6.9061E-03 6.9426E-03 8.9357E-03 7.8695E-03 5.7920E-03 3.1277E-03 2.4337E-03
1.8538E-03 2.5296E-03 2.5844E-03 2.3218E-03 6.5979E-04 6.3924E-05
0 40 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 7.6937E-04 1.9154E-03 2.0090E-03
2.0684E-03 2.0661E-03 1.9269E-03 1.7374E-03 1.0182E-03 1.3515E-03 7.7622E-04 4.6117E-04 3.9496E-04 7.3969E-04
7.4198E-04 1.0433E-03 4.2007E-03 5.6116E-03 6.5956E-03 9.1252E-03 7.4289E-03 4.5820E-03 1.9908E-03 1.4908E-03
1.8173E-03 2.1529E-03 1.6506E-03 1.7465E-03 1.2054E-03 1.1415E-05
0 41 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 6.2098E-04 1.8036E-03
2.0593E-03 2.0387E-03 1.9976E-03 1.9999E-03 2.0456E-03 1.9702E-03 2.0433E-03 1.0707E-03 3.1505E-04 2.2145E-04
1.2739E-03 1.3104E-03 2.8538E-03 4.5500E-03 5.0705E-03 8.2416E-03 6.0477E-03 1.5182E-03 2.2647E-03 1.0707E-03
5.2052E-04 1.0479E-03 1.7488E-03 1.8675E-03 6.3924E-04 0.0000
0 42 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 7.5339E-05
1.6232E-03 1.9109E-03 1.9816E-03 2.0615E-03 2.1026E-03 2.4542E-03 3.4336E-03 2.6414E-03 8.9037E-04 1.6118E-03
1.4862E-03 9.4973E-04 5.3902E-03 7.8581E-03 6.8695E-03 5.8787E-03 3.7966E-03 1.8173E-03 2.3013E-03 2.1300E-03
1.2716E-03 1.7853E-03 1.8538E-03 1.7511E-03 2.9907E-04 0.0000
0 43 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

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    2 9222E-04  1.4223E-03  1.8264E-03  2.0205E-03  2.1803E-03  2 3264E-03  2.3720E-03  2.2214E-03  1.8766E-03  1.8995E-03
    1 6186E-03  2.0273E-03  2.8172E-03  3 8628E-03  2.9337E-03  3.0661E-03  2.6528E-03  2 5045E-03  2.2077E-03  2.4154E-03
    2.0410E-03  1.9177E-03  1.8081E-03  1.3652E-03  2.9679E-04  0.0000
0 44  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    7.3513E-04  1.7282E-03  2.0798E-03  2.1643E-03  1.9337E-03  1.7579E-03  1.8789E-03  1.8150E-03
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    2.0159E-03  1.8652E-03  1.7899E-03  1.0616E-03  6 6207E-05  0.0000
0 45  0.0000    0.0000    0.0000    0 0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    5.9130E-04  8.1503E-04  7.5567E-04  2.0593E-03  1.9931E-03  2.1072E-03  2.1985E-03  2.0935E-03
    2.9268E-03  1.9428E-03  2.1163E-03  2.3081E-03  1 9908E-03  2.0684E-03  2 3309E-03  1.7579E-03  2.3903E-03  1 8903E-03
    1.5935E-03  1.7419E-03  1.3219E-03  2.8766E-04  0 0000    0.0000
0 46  0.0000    0.0000    0.0000    0.0000    0.0000    0 0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0 0000    1.8264E-05  3 9039E-04  6 4381E-04  8.4928E-04  1.7716E-03  2 0752E-03
    2.7442E-03  2.1346E-03  1.9086E-03  2 0684E-03  1.6940E-03  1.8584E-03  2.0570E-03  1 9246E-03  1.7944E-03  1 8926E-03
    1.6095E-03  8.1503E-04  3.4245E-05  0.0000    0.0000    0.0000
0 47  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    2.5113E-05  3.9039E-04
    1.2237E-03  1.9999E-03  1.8766E-03  1.9908E-03  2.0250E-03  1.9132E-03  1.2876E-03  3.1505E-04  3.5843E-04  1.7123E-04
    1.5068E-04  0.0000    0.0000    0.0000    0.0000    0.0000
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    5.4792E-05  9.6343E-04  1.4771E-03  1.0981E-03  9.0635E-04  1.8949E-04  0.0000    0.0000    0.0000    0.0000
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    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
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    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0 50  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
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    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0
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164 RIVER REACHES

0	LAYER	ROW	COL	STAGE	CONDUCTANCE	BOTTOM ELEVATION	RIVER REACH
	1	2	13	0.0000	0.4000E+09	-10.00	1
	1	2	14	0.0000	0.4000E+09	-10.00	2
	1	2	15	0.0000	0.4000E+09	-10.00	3
	1	2	16	0.0000	0.4000E+09	-10.00	4
	1	2	17	0.0000	0.4000E+09	-10.00	5
	1	3	17	0.0000	0.4000E+09	-10.00	6
	1	3	18	0.0000	0.4000E+05	-10.00	7
	1	3	19	0.0000	0.4000E+05	-10.00	8
	1	3	20	0.0000	0.4000E+05	-10.00	9
	1	4	20	0.0000	0.4000E+05	-10.00	10
	1	4	21	0.0000	0.4000E+05	-10.00	11
	1	4	22	0.0000	0.4000E+05	-10.00	12
	1	5	22	0.0000	0.4000E+05	-10.00	13
	1	5	23	0.0000	0.4000E+05	-10.00	14
	1	6	23	0.0000	0.4000E+05	-10.00	15
	1	6	24	0.0000	0.4000E+05	-10.00	16
	1	7	24	0.0000	0.4000E+05	-10.00	17
	1	7	25	0.0000	0.4000E+05	-10.00	18
	1	8	25	0.0000	0.4000E+05	-10.00	19
	1	8	26	0.0000	0.4000E+05	-10.00	20
	1	9	26	0.0000	0.4000E+05	-10.00	21
	1	9	27	0.0000	0.4000E+05	-10.00	22
	1	10	27	0.0000	0.4000E+05	-10.00	23
	1	11	27	0.0000	0.4000E+05	-10.00	24
	1	11	28	0.0000	0.4000E+05	-10.00	25
	1	12	28	0.0000	0.4000E+05	-10.00	26
	1	12	29	0.0000	0.4000E+05	-10.00	27
	1	13	29	0.0000	0.4000E+05	-10.00	28
	1	13	30	0.0000	0.4000E+05	-10.00	29
	1	14	30	0.0000	0.4000E+05	-10.00	30
	1	14	31	0.0000	0.4000E+05	-10.00	31
	1	15	31	0.0000	0.4000E+05	-10.00	32
	1	15	32	0.0000	0.4000E+05	-10.00	33
	1	16	32	0.0000	0.4000E+05	-10.00	34
	1	17	32	0.0000	0.4000E+05	-10.00	35
	1	17	33	0.0000	0.4000E+05	-10.00	36
	1	18	33	0.0000	0.4000E+05	-10.00	37
	1	18	34	0.0000	0.4000E+05	-10.00	38
	1	19	34	0.0000	0.4000E+05	-10.00	39
	1	20	34	0.0000	0.4000E+05	-10.00	40
	1	20	35	0.0000	0.4000E+05	-10.00	41
	1	21	35	0.0000	0.4000E+05	-10.00	42
	1	22	35	0.0000	0.4000E+05	-10.00	43
	1	23	35	0.0000	0.4000E+05	-10.00	44
	1	24	35	0.0000	0.4000E+05	-10.00	45
	1	25	35	0.0000	0.4000E+05	-10.00	46
	1	26	35	0.0000	0.4000E+05	-10.00	47
	1	27	35	0.0000	0.4000E+09	-10.00	48
	1	28	35	0.0000	0.4000E+05	-10.00	49
	1	29	35	0.0000	0.4000E+05	-10.00	50
	1	30	35	0.0000	0.4000E+05	-10.00	51

1	31	35	0.0000	0.4000E+05	-10.00	52
1	32	35	0.0000	0.4000E+05	-10.00	53
1	33	35	0.0000	0.4000E+05	-10.00	54
1	34	35	0.0000	0.4000E+05	-10.00	55
1	35	35	0.0000	0.4000E+05	-10.00	56
1	36	35	0.0000	0.4000E+05	-10.00	57
1	37	35	0.0000	0.4000E+05	-10.00	58
1	38	35	0.0000	0.4000E+05	-10.00	59
1	39	35	0.0000	0.4000E+05	-10.00	60
1	40	35	0.0000	0.4000E+05	-10.00	61
1	41	35	0.0000	0.4000E+05	-10.00	62
1	42	35	0.0000	0.4000E+05	-10.00	63
1	42	34	0.0000	0.4000E+05	-10.00	64
1	43	34	0.0000	0.4000E+05	-10.00	65
1	44	34	0.0000	0.4000E+05	-10.00	66
1	45	34	0.0000	0.4000E+05	-10.00	67
1	45	33	0.0000	0.4000E+05	-10.00	68
1	46	33	0.0000	0.4000E+05	-10.00	69
1	46	32	0.0000	0.4000E+05	-10.00	70
1	47	32	0.0000	0.4000E+05	-10.00	71
1	47	30	0.0000	0.4000E+05	-10.00	72
1	47	31	0.0000	0.4000E+05	-10.00	73
1	48	25	0.0000	0.4000E+05	-10.00	74
1	48	26	0.0000	0.4000E+05	-10.00	75
1	48	27	0.0000	0.4000E+05	-10.00	76
1	48	28	0.0000	0.4000E+05	-10.00	77
1	48	29	0.0000	0.4000E+05	-10.00	78
1	48	30	0.0000	0.4000E+05	-10.00	79
1	49	20	0.0000	0.4000E+09	-10.00	80
1	49	21	0.0000	0.4000E+09	-10.00	81
1	49	22	0.0000	0.4000E+09	-10.00	82
1	49	23	0.0000	0.4000E+09	-10.00	83
1	49	24	0.0000	0.4000E+09	-10.00	84
1	49	25	0.0000	0.4000E+09	-10.00	85
1	48	19	0.0000	0.4000E+09	-10.00	86
1	48	20	0.0000	0.4000E+09	-10.00	87
1	47	15	0.0000	0.4000E+09	-10.00	88
1	47	16	0.0000	0.4000E+09	-10.00	89
1	47	17	0.0000	0.4000E+09	-10.00	90
1	47	18	0.0000	0.4000E+09	-10.00	91
1	47	19	0.0000	0.4000E+09	-10.00	92
1	46	11	0.0000	0.4000E+09	-10.00	93
1	46	12	0.0000	0.4000E+09	-10.00	94
1	46	13	0.0000	0.4000E+09	-10.00	95
1	46	14	0.0000	0.4000E+09	-10.00	96
1	46	15	0.0000	0.4000E+09	-10.00	97
1	44	11	0.0000	0.4000E+09	-10.00	98
1	45	11	0.0000	0.4000E+09	-10.00	99
1	44	10	0.0000	0.4000E+09	-10.00	100
1	43	10	0.0000	0.4000E+09	-10.00	101
1	43	9	0.0000	0.4000E+09	-10.00	102
1	42	9	0.0000	0.4000E+09	-10.00	103
1	42	7	0.0000	0.4000E+09	-10.00	104
1	42	8	0.0000	0.4000E+09	-10.00	105
1	41	7	0.0000	0.4000E+09	-10.00	106
1	41	6	0.0000	0.4000E+09	-10.00	107
1	40	5	0.0000	0.4000E+09	-10.00	108
1	40	6	0.0000	0.4000E+09	-10.00	109
1	39	4	0.0000	0.4000E+09	-10.00	110
1	39	5	0.0000	0.4000E+09	-10.00	111
1	38	3	0.0000	0.4000E+09	-10.00	112
1	38	4	0.0000	0.4000E+09	-10.00	113
1	37	2	0.0000	0.4000E+09	-10.00	114
1	37	3	0.0000	0.4000E+09	-10.00	115
1	35	2	0.0000	0.4000E+09	-10.00	116
1	36	2	0.0000	0.4000E+09	-10.00	117
1	35	3	0.0000	0.4000E+09	-10.00	118
1	30	3	0.0000	0.4000E+09	-10.00	119
1	31	3	0.0000	0.4000E+09	-10.00	120
1	32	3	0.0000	0.4000E+09	-10.00	121
1	33	3	0.0000	0.4000E+09	-10.00	122
1	34	3	0.0000	0.4000E+09	-10.00	123
1	30	4	0.0000	0.4000E+09	-10.00	124
1	28	4	0.0000	0.4000E+09	-10.00	125
1	29	4	0.0000	0.4000E+09	-10.00	126
1	26	5	0.0000	0.4000E+09	-10.00	127
1	27	5	0.0000	0.4000E+09	-10.00	128
1	28	5	0.0000	0.4000E+09	-10.00	129
1	26	6	0.0000	0.4000E+09	-10.00	130
1	26	7	0.0000	0.4000E+09	-10.00	131
1	25	7	0.0000	0.4000E+09	-10.00	132
1	25	8	0.0000	0.4000E+09	-10.00	133
1	24	8	0.0000	0.4000E+09	-10.00	134
1	24	9	0.0000	0.4000E+09	-10.00	135
1	23	9	0.0000	0.4000E+09	-10.00	136
1	23	10	0.0000	0.4000E+09	-10.00	137
1	22	10	0.0000	0.4000E+09	-10.00	138

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          1    22    11  0.0000      0.4000E+09      -10.00        139
          1    19    11  0.0000      0.4000E+09      -10.00        140
          1    20    11  0.0000      0.4000E+09      -10.00        141
          1    21    11  0.0000      0.4000E+09      -10.00        142
          1    14    12  0.0000      0.4000E+09      -10.00        143
          1    15    12  0.0000      0.4000E+09      -10.00        144
          1    16    12  0.0000      0.4000E+09      -10.00        145
          1    17    12  0.0000      0.4000E+09      -10.00        146
          1    18    12  0.0000      0.4000E+09      -10.00        147
          1    19    12  0.0000      0.4000E+09      -10.00        148
          1    12    11  0.0000      0.4000E+09      -10.00        149
          1    13    11  0.0000      0.4000E+09      -10.00        150
          1    14    11  0.0000      0.4000E+09      -10.00        151
          1     5    10  0.0000      0.4000E+09      -10.00        152
          1     6    10  0.0000      0.4000E+09      -10.00        153
          1     7    10  0.0000      0.4000E+09      -10.00        154
          1     8    10  0.0000      0.4000E+09      -10.00        155
          1     9    10  0.0000      0.4000E+09      -10.00        156
          1    10    10  0.0000      0.4000E+09      -10.00        157
          1    11    10  0.0000      0.4000E+09      -10.00        158
          1    12    10  0.0000      0.4000E+09      -10.00        159
          1     4    11  0.0000      0.4000E+09      -10.00        160
          1     5    11  0.0000      0.4000E+09      -10.00        161
          1     3    12  0.0000      0.4000E+09      -10.00        162
          1     4    12  0.0000      0.4000E+09      -10.00        163
          1     3    13  0.0000      0.4000E+09      -10.00        164
0AVERAGE SEED = 0.00078879
 MINIMUM SEED = 0.00000019
0
   5 ITERATION PARAMETERS CALCULATED FROM AVERAGE SEED:

       0.0000000E+00  0.8324129E+00  0.9719146E+00  0.9952933E+00  0.9992112E+00
0
    1 ITERATIONS FOR TIME STEP   1 IN STRESS PERIOD  1
0MAXIMUM HEAD CHANGE FOR EACH ITERATION:
0 HEAD CHANGE LAYER,ROW,COL HEAD CHANGE LAYER,ROW,COL HEAD CHANGE LAYER,ROW,COL HEAD CHANGE LAYER,ROW,COL HEAD CHANGE
LAYER,ROW,COL
 ------------------------------------------------------------------------------
  0.8505E-03 (  1, 36, 20)
0
0HEAD/DRAWDOWN PRINTOUT FLAG = 1    TOTAL BUDGET PRINTOUT FLAG = 0    CELL-BY-CELL FLOW TERM FLAG = 1
0OUTPUT FLAGS FOR ALL LAYERS ARE THE SAME:
  HEAD   DRAWDOWN  HEAD  DRAWDOWN
 PRINTOUT  PRINTOUT  SAVE   SAVE
 ---------------------
   1      0     1     1
0      DRAINS  PERIOD  1  STEP  1  DRAIN  1  LAYER  1  ROW 32  COL  25  RATE  -34925.88
0      DRAINS  PERIOD  1  STEP  1  DRAIN  3  LAYER  1  ROW 33  COL  24  RATE  -8611.835
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  1  LAYER  1  ROW  2  COL  13  RATE  -92.72423
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  2  LAYER  1  ROW  2  COL  14  RATE  -28043.22
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  3  LAYER  1  ROW  2  COL  15  RATE  -41180.27
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  4  LAYER  1  ROW  2  COL  16  RATE  -38509.82
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  5  LAYER  1  ROW  2  COL  17  RATE  -297.9317
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  6  LAYER  1  ROW  3  COL  17  RATE  -260017.6
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  7  LAYER  1  ROW  3  COL  18  RATE  -10177.65
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  8  LAYER  1  ROW  3  COL  19  RATE  -15249.96
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH  9  LAYER  1  ROW  3  COL  20  RATE  -17428.94
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 10  LAYER  1  ROW  4  COL  20  RATE  -21346.47
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 11  LAYER  1  ROW  4  COL  21  RATE  -23593.95
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 12  LAYER  1  ROW  4  COL  22  RATE  -24182.16
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 13  LAYER  1  ROW  5  COL  22  RATE  -27184.64
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 14  LAYER  1  ROW  5  COL  23  RATE  -27640.89
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 15  LAYER  1  ROW  6  COL  23  RATE  -30856.13
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 16  LAYER  1  ROW  6  COL  24  RATE  -30929.57
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 17  LAYER  1  ROW  7  COL  24  RATE  -34086.05
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 18  LAYER  1  ROW  7  COL  25  RATE  -33741.84
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 19  LAYER  1  ROW  8  COL  25  RATE  -36700.64
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 20  LAYER  1  ROW  8  COL  26  RATE  -35968.05
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 21  LAYER  1  ROW  9  COL  26  RATE  -38758.43
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 22  LAYER  1  ROW  9  COL  27  RATE  -37718.82
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 23  LAYER  1  ROW 10  COL  27  RATE  -40347.24
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 24  LAYER  1  ROW 11  COL  27  RATE  -43758.41
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 25  LAYER  1  ROW 11  COL  28  RATE  -42331.44
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 26  LAYER  1  ROW 12  COL  28  RATE  -45103.38
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 27  LAYER  1  ROW 12  COL  29  RATE  -43397.85
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 28  LAYER  1  ROW 13  COL  29  RATE  -46008.22
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 29  LAYER  1  ROW 13  COL  30  RATE  -44089.35
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 30  LAYER  1  ROW 14  COL  30  RATE  -46537.84
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 31  LAYER  1  ROW 14  COL  31  RATE  -44395.05
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 32  LAYER  1  ROW 15  COL  31  RATE  -46668.24
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 33  LAYER  1  ROW 15  COL  32  RATE  -44451.42
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 34  LAYER  1  ROW 16  COL  32  RATE  -46638.89
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 35  LAYER  1  ROW 17  COL  32  RATE  -48871.62
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 36  LAYER  1  ROW 17  COL  33  RATE  -46029.78
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 37  LAYER  1  ROW 18  COL  33  RATE  -47648.09
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 38  LAYER  1  ROW 18  COL  34  RATE  -44849.06
0  RIVER LEAKAGE   PERIOD  1  STEP  1  REACH 39  LAYER  1  ROW 19  COL  34  RATE  -46470.16
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0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	40	LAYER	1	ROW	20	COL	34	RATE	-47663.44
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	41	LAYER	1	ROW	20	COL	35	RATE	-44439.71
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	42	LAYER	1	ROW	21	COL	35	RATE	-45541.65
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	43	LAYER	1	ROW	22	COL	35	RATE	-46206.64
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	44	LAYER	1	ROW	23	COL	35	RATE	-45728.28
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	45	LAYER	1	ROW	24	COL	35	RATE	-43350.37
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	46	LAYER	1	ROW	25	COL	35	RATE	-37955.51
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	47	LAYER	1	ROW	26	COL	35	RATE	-26269.85
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	48	LAYER	1	ROW	27	COL	35	RATE	-997777.6
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	49	LAYER	1	ROW	28	COL	35	RATE	-33742.77
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	50	LAYER	1	ROW	29	COL	35	RATE	-52499.19
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	51	LAYER	1	ROW	30	COL	35	RATE	-64330.21
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	52	LAYER	1	ROW	31	COL	35	RATE	-72783.05
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	53	LAYER	1	ROW	32	COL	35	RATE	-79207.48
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	54	LAYER	1	ROW	33	COL	35	RATE	-84240.19
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	55	LAYER	1	ROW	34	COL	35	RATE	-87911.41
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	56	LAYER	1	ROW	35	COL	35	RATE	-90268.85
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	57	LAYER	1	ROW	36	COL	35	RATE	-91220.87
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	58	LAYER	1	ROW	37	COL	35	RATE	-90626.80
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	59	LAYER	1	ROW	38	COL	35	RATE	-88657.13
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	60	LAYER	1	ROW	39	COL	35	RATE	-85458.98
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	61	LAYER	1	ROW	40	COL	35	RATE	-81297.95
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	62	LAYER	1	ROW	41	COL	35	RATE	-76412.17
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	63	LAYER	1	ROW	42	COL	35	RATE	-72014.78
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	64	LAYER	1	ROW	42	COL	34	RATE	-74666.69
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	65	LAYER	1	ROW	43	COL	34	RATE	-67074.10
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	66	LAYER	1	ROW	44	COL	34	RATE	-58312.19
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	67	LAYER	1	ROW	45	COL	34	RATE	-51680.56
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	68	LAYER	1	ROW	45	COL	33	RATE	-50084.20
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	69	LAYER	1	ROW	46	COL	33	RATE	-40489.55
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	70	LAYER	1	ROW	46	COL	32	RATE	-34916.14
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	71	LAYER	1	ROW	47	COL	32	RATE	-31521.41
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	72	LAYER	1	ROW	47	COL	30	RATE	-31428.78
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	73	LAYER	1	ROW	47	COL	31	RATE	-31272.26
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	74	LAYER	1	ROW	48	COL	25	RATE	-12462.38
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	75	LAYER	1	ROW	48	COL	26	RATE	-22985.18
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	76	LAYER	1	ROW	48	COL	27	RATE	-26727.04
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	77	LAYER	1	ROW	48	COL	28	RATE	-28006.04
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	78	LAYER	1	ROW	48	COL	29	RATE	-28245.12
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	79	LAYER	1	ROW	48	COL	30	RATE	-28416.68
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	80	LAYER	1	ROW	49	COL	20	RATE	-50.81551
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	81	LAYER	1	ROW	49	COL	21	RATE	-11631.84
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	82	LAYER	1	ROW	49	COL	22	RATE	-37540.80
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	83	LAYER	1	ROW	49	COL	23	RATE	-42825.92
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	84	LAYER	1	ROW	49	COL	24	RATE	-42128.72
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	85	LAYER	1	ROW	49	COL	25	RATE	-124465.5
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	86	LAYER	1	ROW	48	COL	19	RATE	-145.7339
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	87	LAYER	1	ROW	48	COL	20	RATE	-39285.30
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	88	LAYER	1	ROW	47	COL	15	RATE	-58.79745
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	89	LAYER	1	ROW	47	COL	16	RATE	-27869.59
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	90	LAYER	1	ROW	47	COL	17	RATE	-23073.21
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	91	LAYER	1	ROW	47	COL	18	RATE	-31481.04
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	92	LAYER	1	ROW	47	COL	19	RATE	-106740.0
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	93	LAYER	1	ROW	46	COL	11	RATE	-132.0927
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	94	LAYER	1	ROW	46	COL	12	RATE	-66061.30
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	95	LAYER	1	ROW	46	COL	13	RATE	-49656.57
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	96	LAYER	1	ROW	46	COL	14	RATE	-77153.77
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	97	LAYER	1	ROW	46	COL	15	RATE	-31051.32
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	98	LAYER	1	ROW	44	COL	11	RATE	-284612.6
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	99	LAYER	1	ROW	45	COL	11	RATE	-66295.58
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	100	LAYER	1	ROW	44	COL	10	RATE	-360.0085
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	101	LAYER	1	ROW	43	COL	10	RATE	-76115.72
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	102	LAYER	1	ROW	43	COL	9	RATE	-83.81532
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	103	LAYER	1	ROW	42	COL	9	RATE	-7867.219
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	104	LAYER	1	ROW	42	COL	7	RATE	-57.87478
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	105	LAYER	1	ROW	42	COL	8	RATE	-11492.12
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	106	LAYER	1	ROW	41	COL	7	RATE	-46498.40
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	107	LAYER	1	ROW	41	COL	6	RATE	-132.0776
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	108	LAYER	1	ROW	40	COL	5	RATE	-180.8516
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	109	LAYER	1	ROW	40	COL	6	RATE	-85843.08
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	110	LAYER	1	ROW	39	COL	4	RATE	-172.4791
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	111	LAYER	1	ROW	39	COL	5	RATE	-95369.48
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	112	LAYER	1	ROW	38	COL	3	RATE	-122.5735
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	113	LAYER	1	ROW	38	COL	4	RATE	-77453.72
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	114	LAYER	1	ROW	37	COL	2	RATE	-57.72408
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	115	LAYER	1	ROW	37	COL	3	RATE	-45364.21
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	116	LAYER	1	ROW	35	COL	2	RATE	-32.92231
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	117	LAYER	1	ROW	36	COL	2	RATE	-12474.78
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	118	LAYER	1	ROW	35	COL	3	RATE	-20513.37
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	119	LAYER	1	ROW	30	COL	3	RATE	-0.1014119
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	120	LAYER	1	ROW	31	COL	3	RATE	-15.20828
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	121	LAYER	1	ROW	32	COL	3	RATE	-6469.845
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	122	LAYER	1	ROW	33	COL	3	RATE	-10433.90
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	123	LAYER	1	ROW	34	COL	3	RATE	-9626.815
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	124	LAYER	1	ROW	30	COL	4	RATE	-86.40639
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	125	LAYER	1	ROW	28	COL	4	RATE	-128.9424
0	RIVER LEAKAGE	PERIOD	1	STEP	1	REACH	126	LAYER	1	ROW	29	COL	4	RATE	-64573.14

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0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 127  LAYER  1  ROW  26  COL   5  RATE  -88 07444
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 128  LAYER  1  ROW  27  COL   5  RATE  -44088.94
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 129  LAYER  1  ROW  28  COL   5  RATE  -64627.08
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 130  LAYER  1  ROW  26  COL   6  RATE  -44161.64
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 131  LAYER  1  ROW  26  COL   7  RATE  -137548.5
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 132  LAYER  1  ROW  25  COL   7  RATE  -261 8047
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 133  LAYER  1  ROW  25  COL   8  RATE  -124779.8
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 134  LAYER  1  ROW  24  COL   8  RATE  -251.7229
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 135  LAYER  1  ROW  24  COL   9  RATE  -127446.4
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 136  LAYER  1  ROW  23  COL   9  RATE  -235.3780
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 137  LAYER  1  ROW  23  COL  10  RATE  -108402.3
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 138  LAYER  1  ROW  22  COL  10  RATE  -271.5677
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 139  LAYER  1  ROW  22  COL  11  RATE  -163708.5
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 140  LAYER  1  ROW  19  COL  11  RATE  -207.1189
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 141  LAYER  1  ROW  20  COL  11  RATE  -53826.54
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 142  LAYER  1  ROW  21  COL  11  RATE  -84271.70
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 143  LAYER  1  ROW  14  COL  12  RATE  -99838.40
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 144  LAYER  1  ROW  15  COL  12  RATE  -68604.00
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 145  LAYER  1  ROW  16  COL  12  RATE  -69496.23
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 146  LAYER  1  ROW  17  COL  12  RATE  -81830.05
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 147  LAYER  1  ROW  18  COL  12  RATE  -87288.31
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 148  LAYER  1  ROW  19  COL  12  RATE  -153706.6
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 149  LAYER  1  ROW  12  COL  11  RATE  -42858.30
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 150  LAYER  1  ROW  13  COL  11  RATE  -29568.88
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 151  LAYER  1  ROW  14  COL  11  RATE  -129.1490
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 152  LAYER  1  ROW   5  COL  10  RATE  -85.61361
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 153  LAYER  1  ROW   6  COL  10  RATE  -25111.96
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 154  LAYER  1  ROW   7  COL  10  RATE  -35815.64
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 155  LAYER  1  ROW   8  COL  10  RATE  -6233.916
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 156  LAYER  1  ROW   9  COL  10  RATE  -7480.935
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 157  LAYER  1  ROW  10  COL  10  RATE  -5238.204
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 158  LAYER  1  ROW  11  COL  10  RATE  -3418.512
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 159  LAYER  1  ROW  12  COL  10  RATE  -46.18445
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 160  LAYER  1  ROW   4  COL  11  RATE  -133.0842
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 161  LAYER  1  ROW   5  COL  11  RATE  -60672.87
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 162  LAYER  1  ROW   3  COL  12  RATE  -137.2694
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 163  LAYER  1  ROW   4  COL  12  RATE  -72677.49
0  RIVER LEAKAGE  PERIOD  1  STEP  1  REACH 164  LAYER  1  ROW   3  COL  13  RATE  -64866.45
1              HEAD IN LAYER  1 AT END OF TIME STEP  1 IN STRESS PERIOD  1
```

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      1      2      3      4      5      6      7      8      9     10
     11     12     13     14     15     16     17     18     19     20
     21     22     23     24     25     26     27     28     29     30
     31     32     33     34     35     36
.......................................................................
0 1  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0 0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 2  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   2.3181E-07  7.0108E-05  1.0295E-04  9.6275E-05  7.4483E-07  0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 3  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   3.4317E-07  1.6217E-04  7.0209E-02  0.1031   9.6448E-02  6.5004E-04  0.2544   0.3812   0.4357
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 4  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     3.3271E-07  1.8169E-04  9.2588E-02  0.1742   0.2313   0.2656   0.2916   0.4010   0.4871   0.5337
     0.5898   0.6046   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 5  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   2.1403E-07
     1.5168E-04  8.9400E-02  0.1907   0.2852   0.3623   0.4232   0.4789   0.5512   0.6142   0.6580
     0.6864   0.6796   0.6910   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 6  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   6.2780E-05
     6.2874E-02  0.1615   0.2766   0.3942   0.4892   0.5651   0.6304   0.6928   0.7445   0.7810
     0.8006   0.7969   0.7714   0.7732   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 7  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   8.9539E-05
     8.9719E-02  0.2062   0.3409   0.5058   0.6151   0.6987   0.7682   0.8276   0.8743   0.9056
     0.9204   0.9161   0.8930   0.8522   0.8435   0.0000   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 8  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   1.5585E-05
     1.5523E-02  111.8    124.8    0.6528   0.7485   0.8300   0.8998   0.9583   1.003    1.031
     1.042    1.035    1.012    0.9720   0.9175   0.8997   0.0000   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 9  0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0 0000   0.0000   0.0000   1.8702E-05
     1.8729E-02  151.2    200.1    154.6    0.8785   0.9555   1.025    1.086    1.132    1.155
     1.162    1.152    1.128    1.089    1.035    0.9690   0.9430   0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 10 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0 0000.  0.0000   0.0000   1.3096E-05
     1.3107E-02  148.5    221.9    217.1    144.6    1.074    1 144    1.210    1.258    1.278
     1.280    1.268    1.243    1.202    1.148    1.082    1.009    0.0000   0.0000   0.0000
     0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
0 11 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   8.5463E-06
```

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    8.5586E-03  109.4     178.1     192.7     190.4     137.0     1.260     1.331     1.377     1.396
    1.394     1.379     1.353     1.313     1.258     1.187     1.094     1.058     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0 12  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     1.1546E-07
    1.0715E-04  9.8929E-02  0.2101     0.2952     148.1     198.8     184.0     1.455     1.486     1.505
    1.505     1.487     1.460     1.420     1.366     1.300     1.219     1.128     1.085     0.0000
    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0 13  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    7.3922E-05  7.4030E-02  0.1968     0.3156     0.4178     172.3     255.0     235.3     1.587     1.607
    1.609     1.589     1.561     1.522     1.471     1.410     1.336     1.250     1.150     1.102
    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
0 14  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    3.2287E-07  2.4960E-04  0.1763     0.3289     0.4593     0.5778     224.3     324.6     217.3     1.718
    1.708     1.684     1.653     1.617     1.573     1.515     1.446     1.366     1.270     1.163
    1.110     0.0000     0.0000     0.0000     0.0000     0.0000
0 15  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     1.7151E-04  0.1716     0.3405     0.4903     0.6224     0.7455     325.7     268.6     1.793
    1.790     1.771     1.742     1.710     1.669     1.615     1.550     1.474     1.382     1.278
    1.167     1.111     0.0000     0.0000     0.0000     0.0000
0 16  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     1.7374E-04  0.1738     0.3497     0.5160     0.6509     0.7588     365.8     383.3     206.6
    1.850     1.854     1.834     1.801     1.762     1.710     1.647     1.571     1.481     1.380
    1.272     1.166     0.0000     0.0000     0.0000     0.0000
0 17  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     2.0458E-04  0.2047     0.3957     0.5479     0.6804     0.7863     394.5     440.1     309.9
    173.8     1.957     1.933     1.894     1.852     1.798     1.735     1.659     1.569     1.470
    1.356     1.222     1.151     0.0000     0.0000     0.0000
0 18  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    0.0000     2.1822E-04  0.2182     0.4157     0.5755     0.7089     0.8153     412.5     472.5     369.3
    252.1     2.026     2.017     1.983     1.937     1.880     1.818     1.738     1.650     1.553
    1.442     1.319     1.191     1.121     0.0000     0.0000
0 19  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    5.1780E-07  3.8427E-04  0.2507     0.4513     0.6095     0.7384     0.8396     419.6     491.5     417.7
    339.9     246.4     2.108     2.071     2.020     1.963     1.896     1.813     1.725     1.629
    1.522     1.402     1.278     1.162     0.0000     0.0000
0 20  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    1.3457E-04  0.1347     0.3276     0.5060     0.6517     0.7681     0.8566     410.9     506.6     457.6
    376.6     287.7     2.191     2.152     2.104     2.044     1.973     1.890     1.799     1.702
    1.592     1.470     1.338     1.192     1.111     0.0000
0 21  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
    2.1068E-04  0.2107     0.4069     0.5724     0.7030     0.8070     0.8864     394.6     509.2     488.0
    392.4     271.8     2.266     2.230     2.180     2.119     2.050     1.966     1.871     1.769
    1.654     1.529     1.393     1.257     1.139     0.0000
0 22  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     6.7892E-07
    4.0927E-04  0.3008     0.4980     0.6490     0.7669     0.8595     0.9288     336.9     448.4     437.6
    376.0     270.7     2.337     2.297     2.253     2.190     2.120     2.037     1.941     1.834
    1.714     1.579     1.433     1.288     1.155     0.0000
0 23  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     5.8845E-07  2.7101E-04
    0.1097     0.4914     0.6120     0.7366     0.8403     0.9210     0.9804     251.9     367.9     401.1
    380.1     290.2     2.391     2.354     2.311     2.257     2.195     2.116     2.019     1.905
    1.774     1.622     1.456     1.291     1.143     0.0000
0 24  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     6.2931E-07  3.1862E-04  0.1623
    0.3281     0.5469     0.6979     0.8214     0.9223     1.000     1.054     231.4     356.3     416.9
    430.2     389.6     270.7     2.398     2.368     2.329     2.279     2.209     2.113     1.989
    1.840     1.661     1.463     1.261     1.084     0.0000
0 25  0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     6.5451E-07  3.1195E-04  0.1575     0.3184
    0.4802     0.6471     0.7888     0.9101     1.011     1.091     1.148     259.2     395.2     475.3
    511.2     505.6     434.1     267.1     2.429     2.412     2.383     2.327     2.235     2.095
    1.918     1.703     1.454     1.187     0.9489     0.0000
0 26  0.0000     0.0000     0.0000     0.0000     2.2019E-07  1.1040E-04  3.4387E-04  0.1556     0.3066     0.4561
    0.6059     0.7524     0.8845     1.001     1.104     1.190     1.255     321.1     469.7     560.2
    617.0     632.3     581.3     470.7     304.9     2.504     2.500     2.468     2.377     2.223
    2.017     1.759     1.447     1.068     0.6567     0.0000
0 27  0.0000     0.0000     0.0000     0.0000     1.1022E-04  0.1104     0.1892     0.3069     0.4390     0.5739
    0.7133     0.8501     0.9786     1.097     1.202     1.293     1.366     373.1     550.7     661.0
    738.0     755.3     721.4     646.7     531.6     364.8     2.644     2.658     2.558     2.378
    2.144     1.855     1.491     0.9660     2.4944E-03  0.0000
0 28  0.0000     0.0000     0.0000     3.2236E-07  1.6157E-04  0.2520     0.3291     0.4346     0.5518     0.6755
    0.8069     0.9405     1.070     1.192     1.303     1.400     1.481     415.4     616.5     760.5
    843.8     869.1     855.5     801.7     712.3     571.5     354.9     2.931     2.780     2.560
    2.302     2.011     1.673     1.273     0.8436     0.0000
0 29  0.0000     0.0000     0.0000     1.6143E-04  0.1619     0.3151     0.4244     0.5301     0.6442     0.7650
    0.8927     1.025     1.158     1.285     1.402     1.506     1.595     454.1     677.9     836.4
    932.9     978.5     991.0     948.2     843.8     656.9     374.0     3.265     3.039     2.767
    2.484     2.196     1.897     1.589     1.312     0.0000
0 30  0.0000     0.0000     2.5353E-10  2.1602E-07  0.3319     0.4116     0.5033     0.6018     0.7126     0.8339
    0.9643     1.101     1.241     1.376     1.500     1.612     1.710     506.9     741.7     895.0
    1001.     1079.     1131.     1116.     993.5     738.2     4.255     3.748     3.326     2.971
    2.658     2.378     2.106     1.843     1.608     0.0000
0 31  0.0000     0.0000     3.8021E-08  2.1960E-05  0.4195     0.4760     0.5552     0.6481     0.7580     0.8835
    1.020     1.166     1.320     1.464     1.595     1.714     1.824     586.6     808.1     953.6
    1078.     1191.     1273.     1287.     1155.     859.2     4.528     4.114     3.533     3.111
    2.786     2.531     2.283     2.042     1.820     0.0000
0 32  0.0000     0.0000     1.6175E-05  1.6197E-02  137.8     177.9     173.7     170.0     184.8     217.6
    262.8     346.1     476.5     529.1     549.5     566.2     608.3     749.4     871.6     1014.
    1154.     1287.     1392.     1406.     1240.     949.2     5.000     4.620     183.5     158.8
    2.821     2.652     2.431     2.201     1.980     0.0000
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0 33  0.0000    0.0000    2.6085E-05 2.6122E-02 193.0    250.7    250.3    243.7    259.7    304.3
     368.1    476.8    476.7    839.1    839.8    840.9    842.2    843.9    845.8    1048.
     1208.    1356.    1476     1506     1404.    1095     5.578    334.8    269.4    192.9
     2.982    2.796    2.567    2.333    2.106    0.0000
0 34  0.0000    0.0000    2.4067E-05 2.4061E-02 192.0    260.3    269.4    252.8    254.8    304.9
     375.9    476.6    476.8    628.5    758.9    759.1    759.2    843.7    847.0    1058.
     1251.    1421.    1531.    1601.    1539.    1319     891.1    470.7    4.039    3.722
     3.273    2.960    2.687    2.434    2.198    0.0000
0 35  0.0000    8.2306E-08 5.1283E-05 2.0184E-02 146.1    200.4    211.0    196.7    182.3    219.1
     302.7    476.5    476.8    628.2    758.8    759.0    759.2    759.4    848.2    1035.
     1280.    1523.    1523.    1667.    1641.    1453.    1047.    4.654    4.197    3.794
     3.398    3.059    2.766    2.500    2.257    0.0000
0 36  0.0000    3.1187E-05 3.1279E-02 0.1249    0.2515    0.3926    0.5439    0.7039    0.8730    1.049
     1.244    1.478    627.3    627.9    758.6    758.8    759.1    759.3    849.2    850.1
     1256.    1492.    1625.    1743.    1729.    1562.    1172.    4.722    4.244    3.815
     3.433    3.096    2.798    2.528    2.281    0.0000
0 37  0.0000    1.4431E-07 1.1341E-04 8.2574E-02 0.1994    0.3365    0.4882    0.6544    0.8315    0.9941
     1.157    273.9    551.0    757.7    758.2    758.6    759.0    759.4    927.7    1020.
     1284.    1504.    1680.    1805.    1804.    1674.    1390.    888.9    4.179    3.745
     3.392    3.073    2.780    2.512    2.266    0.0000
0 38  0.0000    0.0000    3.0643E-07 1.9363E-04 0.1118    0.2463    0.3974    0.5724    0.7849    0.9207
     189.5    318.9    433.1    545.8    757.9    758.3    758.8    927.3    927.8    928.4
     1273.    1514.    1718.    1839.    1853.    1761.    1550.    1199.    705.8    3.566
     3.280    2.986    2.712    2.456    2.216    0.0000
0 39  0.0000    0.0000    0.0000    4.3120E-07 2.3842E-04 0.1275    0.2633    0.4325    91.47    170.0
     242.9    273.0    235.6    1.882    6.649    6.831    926.1    927.1    927.8    928.4
     1276.    1515.    1723.    1841.    1868.    1807.    1629.    1328.    886.6    3.510
     3.151    2.868    2.609    2.366    2.136    0.0000
0 40  0.0000    0.0000    0.0000    0.0000    4.5213E-07 2.1461E-04 8.7904E-02 8.6237E-02 0.1359    168.2
     215.2    174.2    1.601    1.751    6.317    6.667    683.8    854.7    928.0    1090.
     1311.    1514.    1696.    1810.    1845.    1803.    1643.    1374.    1015.    550.5
     2.928    2.701    2.465    2.241    2.032    0.0000
0 41  0.0000    0.0000    0.0000    0.0000    0.0000    3.3019E-07 1.1625E-04 2.8796E-02 1.9696E-02 117.2
     131.9    1.140    1.381    4.846    5.625    342.5    666.8    849.6    981.6    1139.
     1320.    1491.    1647.    1751.    1781.    1744.    1595.    1352.    1063.    680.8
     2.821    2.523    2.291    2.082    1.910    0.0000
0 42  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    1.4469E-07 2.8730E-05 1.9668E-05 1.4448E-02
     0.5255    0.8427    3.201    4.046    155.9    361.4    649.8    840.6    984.1    1139.
     1292.    1438.    1586.    1678.    1689.    1633.    1497.    1298.    1065.    774.9
     404.9    2.268    2.076    1.867    1.800    0.0000
0 43  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    2.0954E-07 1.9029E-04
     0.1766    1.444    2.335    49.31    0.8888    1.054    536.5    768.8    932.2    1063.
     1222.    1349.    1458.    1524.    1523.    1471.    1361.    1204.    1012.    779.0
     486.4    2.127    1.859    1.677    0.0000    0.0000
0 44  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    9.0002E-07
     7.1153E-04 0.5372    0.1318    0.4470    0.6783    0.3055    430.6    646.9    811.6    967.8
     1107.    1216.    1298.    1341.    1331.    1280.    1187.    1055.    898.7    699.2
     483.2    234.1    1.539    1.458    0.0000    0.0000
0 45  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     1.6574E-04 0.1655    0.1241    0.1932    7.7318E-03 0.2175    287.1    448.1    590.3    783.1
     942.6    1043.    1108.    1133.    1108.    1047.    964.0    850.1    708.8    510.0
     350.4    197.1    1.252    1.292    0.0000    0.0000
0 46  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     3.3023E-07 1.6515E-04 1.2414E-04 1.9288E-04 7.7628E-05 6.9825E-02 5.7704E-02 7.8606E-02 0.1980    481.8
     706.6    816.8    869.9    877.2    825.6    716.6    641.0    550.0    405.7    0.9490
     0.8482    0.8729    1.012    0.0000    0.0000    0.0000
0 47  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    1.4699E-07 6.9674E-05 5.7683E-05 7.8703E-05 2.6685E-04 6.9527E-02
     386.7    512.7    555.5    546.5    448.6    0.7995    0.7964    0.7960    0.7782    0.7857
     0.7818    0.7880    0.0000    0.0000    0.0000    0.0000
0 48  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    3.6433E-07 9.8213E-05
     2.9072E-02 9.3986E-02 0.1072    0.1052    0.3116    0.5746    0.6682    0.7002    0.7061    0.7105
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0 49  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    1.2704E-07
     2.9080E-05 9.3852E-05 1.0706E-04 1.0532E-04 3.1116E-04 0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0 50  0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000
0HEAD WILL BE SAVED ON UNIT 30 AT END OF TIME STEP  1, STRESS PERIOD  1
0DRAWDOWN WILL BE SAVED ON UNIT 40 AT END OF TIME STEP  1, STRESS PERIOD  1
```

```
0

                VOLUMETRIC BUDGET FOR ENTIRE MODEL AT END OF TIME STEP  1 IN STRESS PERIOD  1

0          CUMULATIVE VOLUMES      L**3                    RATES FOR THIS TIME STEP      L**3/T

             IN:                                          IN:
             --                                           --
               STORAGE =  0.00000                           STORAGE =  0.00000
          CONSTANT HEAD =  0.00000                     CONSTANT HEAD =  0.00000
               WELLS =  0.00000                             WELLS =  0.00000
               DRAINS =  0.00000                            DRAINS =  0.00000
             RECHARGE =  0.82316E+07                        RECHARGE =  0.82316E+07
          RIVER LEAKAGE =  0.00000                     RIVER LEAKAGE =  0.00000
0            TOTAL IN =  0.82316E+07                      TOTAL IN =  0.82316E+07
0            OUT:                                         OUT:
             ---                                          ---
               STORAGE =  0.00000                           STORAGE =  0.00000
          CONSTANT HEAD =  0.00000                     CONSTANT HEAD =  0.00000
               WELLS =  0.00000                             WELLS =  0.00000
               DRAINS =  43538.                             DRAINS =  43538.
             RECHARGE =  0.00000                            RECHARGE =  0.00000
          RIVER LEAKAGE =  0.81884E+07                   RIVER LEAKAGE =  0.81884E+07
0            TOTAL OUT =  0.82320E+07                     TOTAL OUT =  0.82320E+07
0             IN - OUT =  -338.50                         IN - OUT =  -338.50
0       PERCENT DISCREPANCY =          0.00              PERCENT DISCREPANCY =          0.00


0

      TIME SUMMARY AT END OF TIME STEP  1 IN STRESS PERIOD  1
                 SECONDS      MINUTES      HOURS       DAYS        YEARS

   TIME STEP LENGTH      86400.0     1440.00     24.0000     1.00000     0.273785E-02
  STRESS PERIOD TIME     86400.0     1440.00     24.0000     1.00000     0.273785E-02
TOTAL SIMULATION TIME    86400.0     1440.00     24.0000     1.00000     0.273785E-02
1
```

APPENDIX E

Appendix E-1. GIS Calculated Stress Period Recharge in cfd

Month	Monthly Recharge, *R*, in million cfd							
	Period 1 '42-'51	Period 2 '52-'56	Period 3 '57-'8/61	Period 4 '9/62-/64	Period 5 '65-'69	Period 6 '70-'83	Period 7 '84-'90	Period 8 '91-'94
Jan.	30.50	20.79	26.40	53.91	36.04	35.10	12.48	10.58
Feb.	11.18	9.86	5.19	3.15	16.64	14.10	15.52	10.19
Mar.	19.14	7.43	9.75	35.03	16.36	6.74	6.95	3.86
Apr.	17.51	2.02	2.00	16.96	20.49	8.00	12.19	0.72
May	2.26	1.24	6.38	11.83	9.07	1.82	2.72	2.36
Jun.	1.07	0.42	0.96	0.50	0.60	0.80	0.69	0.99
Jul.	1.64	1.44	0.80	2.91	2.84	1.00	1.45	1.31
Aug.	0.83	0.47	0.67	0.75	0.92	0.80	0.43	0.52
Sep.	1.50	1.80	1.77	0.78	8.22	1.14	1.97	4.73
Oct.	1.86	2.57	2.39	10.54	6.12	2.83	6.37	7.09
Nov.	8.45	16.09	9.48	13.25	29.25	7.19	14.73	6.86
Dec.	13.72	25.03	12.88	11.67	24.92	16.67	22.53	8.95
Year	9.17	7.44	6.56	13.44	14.29	8.02	8.17	4.86

Appendix E-2. GIS Calculated Stress Period Recharge in mgd

Month	Monthly Recharge, *R*, in mgd							
	Period 1 '42-'51	Period 2 '52-'56	Period 3 '57-'8/61	Period 4 '9/62-/64	Period 5 '65-'69	Period 6 '70-'83	Period 7 '84-'90	Period 8 '91-'94
Jan.	228.02	155.41	197.42	403.04	269.44	262.46	93.31	79.11
Feb.	83.60	73.73	38.79	23.54	124.43	105.43	116.03	76.31
Mar.	143.11	55.52	72.90	261.94	122.31	50.36	51.98	28.87
Apr.	130.92	15.14	14.96	126.85	153.20	59.83	91.18	5.39
May	16.93	9.27	47.73	88.47	67.78	13.59	20.36	17.63
Jun.	8.01	3.16	4.16	3.76	4.50	6.00	5.19	7.41
Jul.	12.23	10.80	5.99	21.77	21.21	7.45	10.82	9.82
Aug.	6.21	4.29	5.02	5.62	6.92	5.96	3.20	4.67
Sep.	11.20	13.48	13.27	5.84	61.48	8.49	14.71	35.39
Oct.	13.88	19.18	17.86	78.83	45.74	21.18	47.60	53.01
Nov.	63.20	120.31	70.91	99.08	218.69	53.78	110.11	51.32
Dec.	102.59	187.15	96.33	87.29	186.29	124.67	168.42	66.90
Year	68.33	55.62	49.03	100.50	106.83	59.93	61.08	36.31

Calculated values in feet for input into Lanai Grid in MODFLOW.

```
     1       0
     1       0
    18 0.0002367(10E12.4)                0    '42-51
 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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 0.1690E+01 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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 0.7740E+01 0.8730E+01 0.3690E+01 0.4000E-01 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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 0.8020E+01 0.7220E+01 0.7790E+01 0.7580E+01 0.6630E+01 0.5800E+01 0.1040E+01 0.0000E+00 0.0000E+00 0.0000E+00
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 0.7770E+01 0.7920E+01 0.8040E+01 0.7570E+01 0.6770E+01 0.6600E+01 0.3370E+01 0.0000E+00 0.0000E+00 0.0000E+00
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 0.7130E+01 0.6000E+01 0.7860E+01 0.7370E+01 0.7510E+01 0.8900E+01 0.4900E+01 0.2500E+00 0.0000E+00 0.0000E+00
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 0.1396E+02 0.7000E+01 0.2680E+01 0.5350E+01 0.8050E+01 0.6720E+01 0.8110E+01 0.9420E+01 0.8980E+01 0.4110E+01
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 0.1592E+02 0.6230E+01 0.7800E+00 0.3770E+01 0.6870E+01 0.6510E+01 0.8230E+01 0.1173E+02 0.1125E+02 0.8360E+01
 0.5480E+01 0.3100E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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 0.4240E+01 0.2350E+01 0.1840E+01 0.2420E+01 0.7620E+01 0.7860E+01 0.9280E+01 0.1102E+02 0.8840E+01 0.8680E+01
 0.7900E+01 0.4140E+01 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
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 0.3560E+01 0.1593E+02 0.1365E+02 0.2070E+01 0.7650E+01 0.6020E+01 0.8280E+01 0.9530E+01 0.8150E+01 0.8750E+01
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 0.0000E+00 0.0000E+00 0.5900E+00 0.9680E+01 0.8800E+01 0.1131E+02 0.2139E+02 0.2281E+02 0.1605E+02 0.4500E+00
 0.3870E+01 0.5820E+01 0.8200E+01 0.5800E+01 0.6110E+01 0.1920E+01 0.1015E+02 0.5280E+01 0.6750E+01 0.8750E+01
 0.8650E+01 0.7940E+01 0.6650E+01 0.5700E+00 0.0000E+00 0.0000E+00
 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
 0.0000E+00 0.0000E+00 0.2320E+01 0.1019E+02 0.9200E+01 0.1214E+02 0.1954E+02 0.2272E+02 0.1380E+02 0.2900E+00
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0.4120E+01 0.1798E+02 0.6340E+01 0.8600E+01 0.1780E+01 0.6050E+01 0.6680E+01 0.1750E+01 0.3200E+01 0.7250E+01
0.9050E+01 0.8550E+01 0.7940E+01 0.4670E+01 0.0000E+00 0.0000E+00
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0.1570E+01 0.1414E+02 0.3380E+01 0.6190E+01 0.8120E+01 0.7090E+01 0.5810E+01 0.4020E+01 0.3640E+01 0.7900E+01
0.9190E+01 0.8460E+01 0.7910E+01 0.7680E+01 0.1160E+01 0.0000E+00
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0.3640E+01 0.5080E+01 0.1660E+01 0.1001E+02 0.7310E+01 0.4910E+01 0.8740E+01 0.7280E+01 0.4230E+01 0.5650E+01
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0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
  1    0
  18 0.0002139(10E12.4)          0   70-83
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0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1000E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.1460E+01	0.6200E+01	0.7150E+01	0.4370E+01	0.2500E+01	0.1990E+01	0.2000E-01
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.1800E+00	0.2230E+01	0.7640E+01	0.8750E+01	0.8700E+01	0.8750E+01	0.8640E+01	0.7970E+01	0.7560E+01
0.1690E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.2190E+01	0.8290E+01	0.8500E+01	0.8830E+01	0.9170E+01	0.8420E+01	0.7770E+01	0.7060E+01	0.7320E+01
0.7620E+01	0.3270E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.4840E+01	0.8380E+01	0.8740E+01	0.8740E+01	0.8290E+01	0.7140E+01	0.7710E+01	0.6800E+01	0.6770E+01
0.7740E+01	0.8730E+01	0.3690E+01	0.4000E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.5960E+01	0.8590E+01	0.8830E+01	0.7950E+01	0.7220E+01	0.7220E+01	0.7390E+01	0.7260E+01	0.7100E+01
0.7660E+01	0.8380E+01	0.8940E+01	0.5190E+01	0.7000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.1200E+01	0.8130E+01	0.8720E+01	0.8160E+01	0.7630E+01	0.7670E+01	0.7660E+01	0.7590E+01	0.7340E+01	0.7220E+01
0.8380E+01	0.7560E+01	0.8720E+01	0.7740E+01	0.5170E+01	0.1180E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.3100E+00	0.7250E+01	0.9160E+01	0.9220E+01	0.7740E+01	0.6540E+01	0.6530E+01	0.7340E+01	0.1082E+02	0.8410E+01
0.8020E+01	0.7220E+01	0.7790E+01	0.7580E+01	0.6630E+01	0.5800E+01	0.1040E+01	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.5130E+01	0.9390E+01	0.9920E+01	0.7440E+01	0.8260E+01	0.4020E+01	0.9540E+01	0.1526E+02	0.1009E+02
0.7770E+01	0.7920E+01	0.8040E+01	0.7570E+01	0.6770E+01	0.6600E+01	0.3370E+01	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.4530E+01	0.9830E+01	0.9940E+01	0.8650E+01	0.6830E+01	0.2300E+01	0.1025E+02	0.1659E+02	0.1361E+02
0.7130E+01	0.6000E+01	0.7860E+01	0.7370E+01	0.7510E+01	0.6900E+01	0.4900E+01	0.2500E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.2000E-01	0.7740E+01	0.1016E+02	0.9550E+01	0.9700E+01	0.1395E+02	0.1709E+02	0.9180E+01	0.1086E+02
0.1083E+02	0.6910E+01	0.8390E+01	0.8480E+01	0.6970E+01	0.7250E+01	0.8670E+01	0.4530E+01	0.1300E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.4910E+01	0.1034E+02	0.9780E+01	0.1107E+02	0.1394E+02	0.1855E+02	0.1013E+02	0.3580E+01
0.1226E+02	0.6450E+01	0.8790E+01	0.8390E+01	0.6310E+01	0.7810E+01	0.8670E+01	0.8580E+01	0.3530E+01	0.3200E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.1330E+01	0.1036E+02	0.9770E+01	0.1070E+02	0.1558E+02	0.2188E+02	0.1258E+02	0.8600E+01
0.1396E+02	0.7000E+01	0.2680E+01	0.5350E+01	0.8050E+01	0.6720E+01	0.8110E+01	0.9420E+01	0.8980E+01	0.4110E+01
0.1200E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.3000E-01	0.9460E+01	0.1012E+02	0.1093E+02	0.1549E+02	0.2125E+02	0.5800E+01	0.7150E+01
0.1592E+02	0.6230E+01	0.7800E+00	0.3770E+01	0.6870E+01	0.6510E+01	0.8230E+01	0.1173E+02	0.1125E+02	0.8360E+01
0.5480E+01	0.3100E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.8190E+01	0.1105E+02	0.1138E+02	0.1782E+02	0.2270E+02	0.1903E+02	0.1720E+01
0.4240E+01	0.2350E+01	0.1840E+01	0.2420E+01	0.7620E+01	0.7860E+01	0.9280E+01	0.1102E+02	0.8840E+01	0.8680E+01
0.7900E+01	0.4140E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.8170E+01	0.1051E+02	0.1213E+02	0.1993E+02	0.2258E+02	0.1718E+02	0.1160E+01
0.3560E+01	0.1593E+02	0.1365E+02	0.2070E+01	0.7650E+01	0.6020E+01	0.8280E+01	0.9530E+01	0.8150E+01	0.8750E+01
0.8250E+01	0.7650E+01	0.1420E+01	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.5900E+00	0.9680E+01	0.8800E+01	0.1131E+02	0.2139E+02	0.2281E+02	0.1605E+02	0.4500E+00
0.3870E+01	0.5820E+01	0.8200E+01	0.5800E+01	0.6110E+01	0.1920E+01	0.1015E+02	0.5280E+01	0.6750E+01	0.8750E+01
0.8650E+01	0.7940E+01	0.6650E+01	0.5700E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.2320E+01	0.1019E+02	0.9200E+01	0.1214E+02	0.1954E+02	0.2272E+02	0.1380E+02	0.2900E+00
0.4120E+01	0.1798E+02	0.6340E+01	0.8600E+01	0.1780E+01	0.6050E+01	0.6680E+01	0.1750E+01	0.3200E+01	0.7250E+01
0.9050E+01	0.8550E+01	0.7940E+01	0.4670E+01	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.5230E+01	0.9180E+01	0.8860E+01	0.8100E+01	0.6020E+01	0.1867E+02	0.1581E+02	0.3050E+01

0.1570E+01	0.1414E+02	0.3380E+01	0.6190E+01	0.8120E+01	0.7090E+01	0 5810E+01	0.4020E+01	0.3640E+01	0.7900E+01
0.9190E+01	0.8460E+01	0.7910E+01	0.7680E+01	0.1160E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.8320E+01	0.1072E+02	0.6150E+01	0.4750E+01	0.3540E+01	0.1854E+02	0.1873E+02	0.1441E+02
0.3640E+01	0.5080E+01	0.1660E+01	0.1001E+02	0.7310E+01	0.4910E+01	0.8740E+01	0.7280E+01	0.4230E+01	0.5650E+01
0.6190E+01	0.8090E+01	0.7440E+01	0.7510E+01	0.2520E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.1150E+01	0.1011E+02	0.9670E+01	0.6960E+01	0.6280E+01	0.5390E+01	0.1289E+02	0.1196E+02	0.2970E+01
0.1160E+01	0.5900E+01	0.9220E+01	0.7080E+01	0.1417E+02	0.5420E+01	0.4110E+01	0.2420E+01	0.1730E+01	0.3300E+01
0.6160E+01	0.7590E+01	0.6690E+01	0.7160E+01	0.4660E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.1000E+00	0.6360E+01	0.1055E+02	0.1040E+02	0.6330E+01	0.1470E+01	0.2010E+01	0.4300E+00	0.0000E+00	0.0000E+00
0.1350E+01	0.3390E+01	0.7300E+01	0.7580E+01	0.4820E+01	0.1490E+01	0.3210E+01	0.1120E+01	0.5100E+00	0.1380E+01
0.7210E+01	0.7370E+01	0.7470E+01	0.7460E+01	0.5810E+01	0.1000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8900E+00
0.5840E+01	0.1005E+02	0.9790E+01	0.8180E+01	0.7150E+01	0.5850E+01	0.9500E+00	0.1200E+00	0.0000E+00	0.0000E+00
0.1490E+01	0.3190E+01	0.8570E+01	0.1460E+01	0.2280E+01	0.5100E+00	0.1200E+00	0.2700E+00	0.2200E+00	0.1330E+01
0.6970E+01	0.8190E+01	0.7690E+01	0.7810E+01	0.2860E+01	0.1200E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1900E+01	0.7570E+01
0.9230E+01	0.8750E+01	0.6840E+01	0.8170E+01	0.6710E+01	0.7150E+01	0.4910E+01	0.1430E+01	0.2000E-01	0.7100E+00
0.6300E+00	0.3580E+01	0.5750E+01	0.1300E+00	0.7000E+00	0.1200E+01	0.6710E+01	0.5230E+01	0.1159E+02	0.7440E+01
0.7250E+01	0.7970E+01	0.7280E+01	0.7100E+01	0.5930E+01	0.5000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.9000E-01	0.2710E+01	0.7930E+01	0.8510E+01
0.9440E+01	0.9690E+01	0.7610E+01	0.3640E+01	0.4850E+01	0.7490E+01	0.6230E+01	0.7160E+01	0.2600E+01	0.2900E+00
0.1330E+01	0.6080E+01	0.4100E+01	0.1760E+01	0.2050E+01	0.1400E+00	0.1270E+01	0.3750E+01	0.1111E+02	0.9940E+01
0.1129E+02	0.6660E+01	0.7080E+01	0.6990E+01	0.6660E+01	0.2800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3540E+01	0.7520E+01	0.6510E+01	0.5050E+01
0.7230E+01	0.6730E+01	0.5870E+01	0.5670E+01	0.5850E+01	0.6550E+01	0.6850E+01	0.7730E+01	0.5600E+01	0.1930E+01
0.7590E+01	0.6020E+01	0.3350E+01	0.3010E+01	0.3130E+01	0.1118E+02	0.1116E+02	0.1442E+02	0.1650E+02	0.1264E+02
0.9610E+01	0.6490E+01	0.1015E+02	0.1176E+02	0.1448E+02	0.1060E+01				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.5800E+00	0.7110E+01	0.8030E+01	0.6050E+01	0.1910E+01
0.2410E+01	0.4510E+01	0.4330E+01	0.5790E+01	0.6360E+01	0.7180E+01	0.7680E+01	0.7560E+01	0.3080E+01	0.8360E+01
0.8710E+01	0.4620E+01	0.3170E+01	0.2710E+01	0.8020E+01	0.1460E+02	0.2262E+02	0.1709E+02	0.1489E+02	0.4540E+01
0.4450E+01	0.7410E+01	0.7800E+01	0.9400E+01	0.1104E+02	0.3700E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4690E+01	0.8660E+01	0.6840E+01	0.7480E+01	0.6110E+01
0.4040E+01	0.3740E+01	0.4550E+01	0.5170E+01	0.5820E+01	0.7460E+01	0.7760E+01	0.5890E+01	0.2880E+01	0.8360E+01
0.9200E+01	0.4940E+01	0.5560E+01	0.2490E+01	0.4080E+01	0.4540E+01	0.2103E+02	0.1034E+02	0.7490E+01	0.6220E+01
0.4990E+01	0.6530E+01	0.1015E+02	0.1367E+02	0.1173E+02	0.3100E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1270E+01	0.8730E+01	0.8840E+01	0.5690E+01	0.5470E+01	0.4410E+01
0.4210E+01	0.3430E+01	0.4420E+01	0.6010E+01	0.6550E+01	0.7120E+01	0.7770E+01	0.6690E+01	0.5090E+01	0.4420E+01
0.1410E+01	0.7900E+00	0.8430E+01	0.1362E+02	0.1143E+02	0.2052E+02	0.1758E+02	0.1260E+02	0.5670E+01	0.9480E+01
0.6260E+01	0.9390E+01	0.1088E+02	0.1096E+02	0.4390E+01	0.4000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.6540E+01	0.8740E+01	0.7520E+01	0.3830E+01	0.3160E+01	0.4930E+01
0.4450E+01	0.4020E+01	0.4960E+01	0.6220E+01	0.6480E+01	0.7190E+01	0.6430E+01	0.7070E+01	0.6160E+01	0.3900E+00
0.0000E+00	0.5870E+01	0.1468E+02	0.3291E+02	0.3346E+02	0.3538E+02	0.1700E+02	0.1220E+02	0.1089E+02	0.1088E+02
0.9720E+01	0.1094E+02	0.9150E+01	0.8890E+01	0.4280E+01	0.3800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8280E+01	0.7330E+01	0.4080E+01	0.2960E+01	0.3550E+01	0.4830E+01
0.3750E+01	0.4930E+01	0.4690E+01	0.4750E+01	0.6110E+01	0.6300E+01	0.5920E+01	0.7160E+01	0.7470E+01	0.1870E+01
0.2500E+01	0.7740E+01	0.2301E+02	0.3675E+02	0.3814E+02	0.3341E+02	0.3024E+02	0.2513E+02	0.1509E+02	0.1275E+02
0.1090E+02	0.1194E+02	0.9280E+01	0.7880E+01	0.4880E+01	0.4100E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.9200E+00	0.1006E+02	0.8180E+01	0.4210E+01	0.2650E+01	0.3280E+01	0.4420E+01
0.2980E+01	0.4550E+01	0.2750E+01	0.4480E+01	0.4090E+01	0.2700E+01	0.3540E+01	0.7480E+01	0.8590E+01	0.7040E+01
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0.1425E+02	0.1044E+02	0.9390E+01	0.9710E+01	0.7400E+01	0.5900E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.8000E-01	0.8560E+01	0.8870E+01	0.7340E+01	0.3150E+01	0.9700E+00	0.4250E+01
0.3230E+01	0.4890E+01	0.3650E+01	0.3400E+01	0.2790E+01	0.3780E+01	0.3960E+01	0.7310E+01	0.8570E+01	0.3740E+01
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0.1370E+02	0.1020E+02	0.9920E+01	0.8550E+01	0.6490E+01	0.3800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.1230E+01	0.8880E+01	0.9540E+01	0.9230E+01	0.6870E+01	0.1500E+01	0.2330E+01
0.3340E+01	0.4920E+01	0.3740E+01	0.4200E+01	0.4140E+01	0.4800E+01	0.7330E+01	0.7710E+01	0.8340E+01	0.9280E+01
0.3610E+01	0.1142E+02	0.9190E+01	0.3423E+02	0.3655E+02	0.3714E+02	0.3481E+02	0.3369E+02	0.2524E+02	0.1906E+02
0.1418E+02	0.6420E+01	0.8490E+01	0.6790E+01	0.7090E+01	0.2100E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.4090E+01	0.8900E+01	0.9030E+01	0.8980E+01	0.7050E+01	0.5310E+01	0.3560E+01
0.2500E+01	0.4450E+01	0.4900E+01	0.3510E+01	0.3260E+01	0.5690E+01	0.7270E+01	0.7750E+01	0.7920E+01	0.9170E+01
0.9040E+01	0.7930E+01	0.1149E+02	0.3351E+02	0.3617E+02	0.3619E+02	0.3146E+02	0.3333E+02	0.2809E+02	0.1881E+02
0.1329E+02	0.9690E+01	0.9920E+01	0.8850E+01	0.7980E+01	0.2800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.2460E+01	0.6680E+01	0.8580E+01	0.8930E+01	0.9370E+01	0.8550E+01	0.7840E+01
0.7380E+01	0.4030E+01	0.4050E+01	0.2920E+01	0.4020E+01	0.5380E+01	0.6690E+01	0.7520E+01	0.7590E+01	0.7860E+01
0.8560E+01	0.5740E+01	0.1247E+02	0.3591E+02	0.3624E+02	0.3400E+02	0.3189E+02	0.3058E+02	0.2275E+02	0.1243E+02
0.1668E+02	0.1573E+02	0.1131E+02	0.8050E+01	0.5860E+01	0.6000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4600E+00	0.5130E+01	0.8490E+01	0.8860E+01	0.8800E+01	0.8080E+01
0.7570E+01	0.6520E+01	0.3110E+01	0.2300E+01	0.2900E+01	0.2480E+01	0.3790E+01	0.4580E+01	0.4380E+01	0.7760E+01
0.7000E+01	0.4010E+01	0.2380E+02	0.3314E+02	0.3442E+02	0.3402E+02	0.3649E+02	0.3057E+02	0.1934E+02	0.1442E+02
0.1067E+02	0.5070E+01	0.6900E+01	0.7490E+01	0.5080E+01	0.3000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3430E+01	0.8380E+01	0.8790E+01	0.8830E+01
0.8210E+01	0.8120E+01	0.8030E+01	0.4150E+01	0.2670E+01	0.2240E+01	0.2850E+01	0.3890E+01	0.4790E+01	0.5350E+01
0.3750E+01	0.2060E+01	0.2456E+02	0.3025E+02	0.3041E+02	0.3914E+02	0.3447E+02	0.2537E+02	0.1370E+02	0.1066E+02
0.8120E+01	0.1108E+02	0.1132E+02	0.1017E+02	0.2890E+01	0.2800E+00				

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0.3100E+00	0.7250E+01	0.9160E+01	0.9220E+01	0.7740E+01	0.8540E+01	0.6530E+01	0.7340E+01	0.1082E+02	0.8410E+01
0.8020E+01	0.7220E+01	0.7790E+01	0.7580E+01	0.6630E+01	0.5800E+01	0.1040E+01	0.0000E+00	0.0000E+00	0.0000E+00
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0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.5130E+01	0.9390E+01	0.9920E+01	0.7440E+01	0.8260E+01	0.4020E+01	0.9540E+01	0.1526E+02	0.1009E+02
0.7770E+01	0.7920E+01	0.8040E+01	0.7570E+01	0.6770E+01	0.6600E+01	0.3370E+01	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.4530E+01	0.9830E+01	0.9940E+01	0.8650E+01	0.6830E+01	0.2300E+01	0.1025E+02	0.1659E+02	0.1361E+02
0.7130E+01	0.6000E+01	0.7860E+01	0.7370E+01	0.7510E+01	0.6900E+01	0.4900E+01	0.2500E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.2000E-01	0.7740E+01	0.1016E+02	0.9550E+01	0.9700E+01	0.1395E+02	0.1709E+02	0.9180E+01	0.1086E+02
0.1083E+02	0.6910E+01	0.8390E+01	0.8480E+01	0.6970E+01	0.7250E+01	0.8670E+01	0.4530E+01	0.1300E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.4910E+01	0.1034E+02	0.9780E+01	0.1107E+02	0.1394E+02	0.1855E+02	0.1013E+02	0.3580E+01
0.1226E+02	0.6450E+01	0.8790E+01	0.8390E+01	0.6310E+01	0.7810E+01	0.8670E+01	0.8580E+01	0.3530E+01	0.3200E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.1330E+01	0.1036E+02	0.9770E+01	0.1070E+02	0.1558E+02	0.2188E+02	0.1258E+02	0.8600E+01
0.1396E+02	0.7000E+01	0.2680E+01	0.5350E+01	0.8050E+01	0.6720E+01	0.8110E+01	0.9420E+01	0.8980E+01	0.4110E+01
0.1200E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.3000E-01	0.9480E+01	0.1012E+02	0.1093E+02	0.1549E+02	0.2125E+02	0.5800E+01	0.7150E+01
0.1592E+02	0.6230E+01	0.7800E+00	0.3770E+01	0.6870E+01	0.6510E+01	0.8230E+01	0.1173E+02	0.1125E+02	0.8360E+01
0.5480E+01	0.3100E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.8190E+01	0.1105E+02	0.1138E+02	0.1782E+02	0.2270E+02	0.1903E+02	0.1720E+01
0.4240E+01	0.2350E+01	0.1840E+01	0.2420E+01	0.7620E+01	0.7860E+01	0.9280E+01	0.1102E+02	0.8840E+01	0.8680E+01
0.7900E+01	0.4140E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.8170E+01	0.1051E+02	0.1213E+02	0.1993E+02	0.2258E+02	0.1718E+02	0.1160E+01
0.3560E+01	0.1593E+02	0.1365E+02	0.2070E+01	0.7650E+01	0.6020E+01	0.8280E+01	0.9530E+01	0.8150E+01	0.8750E+01
0.8250E+01	0.7650E+01	0.1420E+01	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.5900E+00	0.9680E+01	0.8800E+01	0.1131E+02	0.2139E+02	0.2281E+02	0.1605E+02	0.4500E+00
0.3870E+01	0.5820E+01	0.8200E+01	0.5800E+01	0.6110E+01	0.1920E+01	0.1015E+02	0.5280E+01	0.6750E+01	0.8750E+01
0.8650E+01	0.7940E+01	0.6650E+01	0.5700E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.2320E+01	0.1019E+02	0.9200E+01	0.1214E+02	0.1954E+02	0.2272E+02	0.1380E+02	0.2900E+00
0.4120E+01	0.1798E+02	0.6340E+01	0.8600E+01	0.1780E+01	0.6050E+01	0.6680E+01	0.1750E+01	0.3200E+01	0.7250E+01
0.9050E+01	0.8550E+01	0.7940E+01	0.4670E+01	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.5230E+01	0.9180E+01	0.8860E+01	0.8100E+01	0.6020E+01	0.1867E+02	0.1581E+02	0.3050E+01
0.1570E+01	0.1414E+02	0.3380E+01	0.6190E+01	0.8120E+01	0.7090E+01	0.5810E+01	0.4020E+01	0.3640E+01	0.7900E+01
0.9190E+01	0.8460E+01	0.7910E+01	0.7680E+01	0.1160E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.8320E+01	0.1072E+02	0.6150E+01	0.4750E+01	0.3540E+01	0.1854E+02	0.1873E+02	0.1441E+02
0.3640E+01	0.5080E+01	0.1660E+01	0.1001E+02	0.7310E+01	0.4910E+01	0.8740E+01	0.7280E+01	0.4230E+01	0.5650E+01
0.6190E+01	0.8090E+01	0.7440E+01	0.7510E+01	0.2520E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.1150E+01	0.1011E+02	0.9670E+01	0.6960E+01	0.6280E+01	0.5390E+01	0.1289E+02	0.1196E+02	0.2970E+01
0.1160E+01	0.5900E+01	0.9220E+01	0.7080E+01	0.1417E+02	0.5420E+01	0.4110E+01	0.2420E+01	0.1730E+01	0.3300E+01
0.6160E+01	0.7590E+01	0.6690E+01	0.7160E+01	0.4660E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.1000E+00	0.6360E+01	0.1055E+02	0.1040E+02	0.6330E+01	0.1470E+01	0.2010E+01	0.4300E+00	0.0000E+00	0.0000E+00
0.1350E+01	0.3390E+01	0.7300E+01	0.7580E+01	0.4820E+01	0.1490E+01	0.3210E+01	0.1120E+01	0.5100E+00	0.1380E+01
0.7210E+01	0.7370E+01	0.7470E+01	0.7460E+01	0.5810E+01	0.1000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8900E+00
0.5840E+01	0.1005E+02	0.9790E+01	0.8180E+01	0.7150E+01	0.5850E+01	0.9500E+00	0.1200E+00	0.0000E+00	0.0000E+00
0.1490E+01	0.3190E+01	0.8570E+01	0.1460E+01	0.2280E+01	0.5100E+00	0.1200E+00	0.2700E+00	0.2200E+00	0.1330E+01
0.6970E+01	0.8190E+01	0.7690E+01	0.7810E+01	0.2860E+01	0.1200E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1900E+01	0.7570E+01
0.9230E+01	0.8750E+01	0.6840E+01	0.8170E+01	0.6710E+01	0.7150E+01	0.4910E+01	0.1430E+01	0.2000E-01	0.7100E+00
0.6300E+00	0.3580E+01	0.5750E+01	0.1300E+00	0.7000E+00	0.1200E+01	0.6710E+01	0.5230E+01	0.1159E+02	0.7440E+01
0.7250E+01	0.7970E+01	0.7280E+01	0.7100E+01	0.5930E+01	0.5000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.9000E-01	0.2710E+01	0.7930E+01	0.8510E+01
0.9440E+01	0.9690E+01	0.7610E+01	0.3640E+01	0.4850E+01	0.7490E+01	0.6230E+01	0.7160E+01	0.2600E+01	0.2900E+00
0.1330E+01	0.6080E+01	0.4100E+01	0.1760E+01	0.2050E+01	0.1400E+00	0.1270E+01	0.3750E+01	0.1111E+02	0.9940E+01
0.1129E+02	0.6660E+01	0.7080E+01	0.6990E+01	0.6660E+01	0.2800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3540E+01	0.7520E+01	0.6510E+01	0.5050E+01
0.7230E+01	0.6730E+01	0.5870E+01	0.5670E+01	0.5850E+01	0.6550E+01	0.6850E+01	0.7730E+01	0.5600E+01	0.1930E+01
0.7590E+01	0.6020E+01	0.3350E+01	0.3010E+01	0.3130E+01	0.1118E+02	0.1116E+02	0.1442E+02	0.1650E+02	0.1264E+02
0.9610E+01	0.6490E+01	0.1015E+02	0.1178E+02	0.1448E+02	0.1060E+01				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.5800E+00	0.7110E+01	0.8030E+01	0.6050E+01	0.1910E+01
0.2410E+01	0.4510E+01	0.4330E+01	0.5790E+01	0.6360E+01	0.7180E+01	0.7680E+01	0.7560E+01	0.3080E+01	0.8360E+01

0.8710E+01 0.4620E+01 0.3170E+01 0.2710E+01 0.8020E+01 0.1460E+02 0.2262E+02 0.1709E+02 0.1489E+02 0.4540E+01
0.4450E+01 0.7410E+01 0.7800E+01 0.9400E+01 0.1104E+02 0.3700E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.4690E+01 0.8660E+01 0.6840E+01 0.7480E+01 0.6110E+01
0.4040E+01 0.3740E+01 0.4550E+01 0.5170E+01 0.5820E+01 0.7460E+01 0.7760E+01 0.5890E+01 0.2880E+01 0.8360E+01
0.9200E+01 0.4940E+01 0.5560E+01 0.2490E+01 0.4080E+01 0.4540E+01 0.2103E+02 0.1034E+02 0.7490E+01 0.6220E+01
0.4990E+01 0.6530E+01 0.1015E+02 0.1367E+02 0.1173E+02 0.3100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.1270E+01 0.8730E+01 0.8840E+01 0.5690E+01 0.5470E+01 0.4410E+01
0.4210E+01 0.3430E+01 0.4420E+01 0.6010E+01 0.8550E+01 0.7120E+01 0.7770E+01 0.6690E+01 0.5090E+01 0.4420E+01
0.1410E+01 0.7900E+00 0.8430E+01 0.1362E+02 0.1143E+02 0.2052E+02 0.1758E+02 0.1260E+02 0.5670E+01 0.9480E+01
0.6260E+01 0.9390E+01 0.1088E+02 0.1096E+02 0.4390E+01 0.4000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.6540E+01 0.8740E+01 0.7520E+01 0.3830E+01 0.3160E+01 0.4930E+01
0.4450E+01 0.4020E+01 0.4960E+01 0.6220E+01 0.6480E+01 0.7190E+01 0.6430E+01 0.7070E+01 0.6160E+01 0.3900E+00
0.0000E+00 0.5870E+01 0.1468E+02 0.3291E+02 0.3346E+02 0.3538E+02 0.1700E+02 0.1220E+02 0.1089E+02 0.1088E+02
0.9720E+01 0.1094E+02 0.9150E+01 0.8890E+01 0.4280E+01 0.3800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.8280E+01 0.7330E+01 0.4080E+01 0.2960E+01 0.3550E+01 0.4830E+01
0.3750E+01 0.4930E+01 0.4690E+01 0.4750E+01 0.8110E+01 0.6300E+01 0.5920E+01 0.7160E+01 0.7470E+01 0.1870E+01
0.2500E+01 0.7740E+01 0.2301E+02 0.3675E+02 0.3814E+02 0.3341E+02 0.3024E+02 0.2513E+02 0.1509E+02 0.1275E+02
0.1090E+02 0.1194E+02 0.9280E+01 0.7880E+01 0.4880E+01 0.4100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.9200E+00 0.1006E+02 0.8180E+01 0.4210E+01 0.2650E+01 0.3280E+01 0.4420E+01
0.2980E+01 0.4550E+01 0.2750E+01 0.4480E+01 0.4090E+01 0.2700E+01 0.3540E+01 0.7480E+01 0.8590E+01 0.7040E+01
0.1180E+01 0.3410E+01 0.2328E+02 0.3659E+02 0.3830E+02 0.4091E+02 0.3999E+02 0.3429E+02 0.2178E+02 0.1758E+02
0.1425E+02 0.1044E+02 0.9390E+01 0.9710E+01 0.7400E+01 0.5900E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.8000E-01 0.8560E+01 0.8870E+01 0.7340E+01 0.3150E+01 0.9700E+00 0.4250E+01
0.3230E+01 0.4890E+01 0.3650E+01 0.3400E+01 0.2790E+01 0.3780E+01 0.3960E+01 0.7310E+01 0.8570E+01 0.3740E+01
0.3030E+01 0.1050E+01 0.2106E+02 0.3381E+02 0.3667E+02 0.3926E+02 0.3837E+02 0.2735E+02 0.2154E+02 0.1641E+02
0.1370E+02 0.1020E+02 0.9920E+01 0.8550E+01 0.6490E+01 0.3800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.1230E+01 0.8880E+01 0.9540E+01 0.9230E+01 0.6870E+01 0.1500E+01 0.2330E+01
0.3340E+01 0.4920E+01 0.3740E+01 0.4200E+01 0.4140E+01 0.4800E+01 0.7330E+01 0.7710E+01 0.8340E+01 0.9280E+01
0.3610E+01 0.1142E+02 0.9190E+01 0.3423E+02 0.3655E+02 0.3714E+02 0.3481E+02 0.3369E+02 0.2524E+02 0.1906E+02
0.1418E+02 0.6420E+01 0.8490E+01 0.6790E+01 0.7090E+01 0.2100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.4090E+01 0.8900E+01 0.9030E+01 0.8980E+01 0.7050E+01 0.5310E+01 0.3560E+01
0.2500E+01 0.4450E+01 0.4900E+01 0.3510E+01 0.3260E+01 0.5690E+01 0.7270E+01 0.7750E+01 0.7920E+01 0.9170E+01
0.9040E+01 0.7930E+01 0.1149E+02 0.3351E+02 0.3617E+02 0.3619E+02 0.3146E+02 0.3333E+02 0.2809E+02 0.1881E+02
0.1329E+02 0.9690E+01 0.9920E+01 0.8850E+01 0.7980E+01 0.2800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.2460E+01 0.6680E+01 0.8580E+01 0.8930E+01 0.9370E+01 0.8550E+01 0.7840E+01
0.7380E+01 0.4030E+01 0.4050E+01 0.2920E+01 0.4020E+01 0.5380E+01 0.6690E+01 0.7520E+01 0.7590E+01 0.7860E+01
0.8560E+01 0.5740E+01 0.1247E+02 0.3591E+02 0.3624E+02 0.3400E+02 0.3189E+02 0.3058E+02 0.2275E+02 0.1243E+02
0.1668E+02 0.1573E+02 0.1131E+02 0.8050E+01 0.5860E+01 0.6000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.4600E+00 0.5130E+01 0.8490E+01 0.8860E+01 0.8800E+01 0.8080E+01
0.7570E+01 0.6520E+01 0.3110E+01 0.2300E+01 0.2900E+01 0.2480E+01 0.3790E+01 0.4580E+01 0.4380E+01 0.7760E+01
0.7000E+01 0.4010E+01 0.2380E+02 0.3314E+02 0.3442E+02 0.3402E+02 0.3649E+02 0.3057E+02 0.1934E+02 0.1442E+02
0.1067E+02 0.5070E+01 0.6900E+01 0.7490E+01 0.5080E+01 0.3000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.3430E+01 0.8380E+01 0.8790E+01 0.8830E+01
0.8210E+01 0.8120E+01 0.8030E+01 0.4150E+01 0.2670E+01 0.2240E+01 0.2850E+01 0.3890E+01 0.4790E+01 0.5350E+01
0.3750E+01 0.2060E+01 0.2456E+02 0.3025E+02 0.3041E+02 0.3914E+02 0.3447E+02 0.2537E+02 0.1370E+02 0.1066E+02
0.8120E+01 0.1108E+02 0.1132E+02 0.1017E+02 0.2890E+01 0.2800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.3370E+01 0.8390E+01 0.8800E+01
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0.7210E+01 0.7370E+01 0.7470E+01 0.7460E+01 0.5810E+01 0.1000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.8900E+00
0.5840E+01 0.1005E+02 0.9790E+01 0.8180E+01 0.7150E+01 0.5850E+01 0.9500E+00 0.1200E+00 0.0000E+00 0.0000E+00
0.1490E+01 0.3190E+01 0.8570E+01 0.1460E+01 0.2280E+01 0.5100E+00 0.1200E+00 0.2700E+00 0.2200E+00 0.1330E+01
0.6970E+01 0.8190E+01 0.7690E+01 0.7810E+01 0.2860E+01 0.1200E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.1900E+01 0.7570E+01
0.9230E+01 0.8750E+01 0.6840E+01 0.8170E+01 0.6710E+01 0.7150E+01 0.4910E+01 0.1430E+01 0.2000E-01 0.7100E+00
0.6300E+00 0.3580E+01 0.5750E+01 0.1300E+00 0.7000E+00 0.1200E+01 0.6710E+01 0.5230E+01 0.1159E+02 0.7440E+01
0.7250E+01 0.7970E+01 0.7280E+01 0.7100E+01 0.5930E+01 0.5000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.9000E-01 0.2710E+01 0.7930E+01 0.8510E+01
0.9440E+01 0.9690E+01 0.7610E+01 0.3640E+01 0.4850E+01 0.7490E+01 0.6230E+01 0.7160E+01 0.2600E+01 0.2900E+00
0.1330E+01 0.6080E+01 0.4100E+01 0.1760E+01 0.2050E+01 0.1400E+00 0.1270E+01 0.3750E+01 0.1111E+02 0.9940E+01
0.1129E+02 0.6660E+01 0.7080E+01 0.6990E+01 0.6660E+01 0.2800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.3540E+01 0.7520E+01 0.6510E+01 0.5050E+01
0.7230E+01 0.6730E+01 0.5870E+01 0.5670E+01 0.5850E+01 0.6550E+01 0.6850E+01 0.7730E+01 0.5600E+01 0.1930E+01
0.7590E+01 0.6020E+01 0.3350E+01 0.3010E+01 0.3130E+01 0.1118E+02 0.1116E+02 0.1442E+02 0.1650E+02 0.1264E+02
0.9610E+01 0.6490E+01 0.1015E+02 0.1176E+02 0.1448E+02 0.1060E+01
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.5800E+00 0.7110E+01 0.8030E+01 0.6050E+01 0.1910E+01
0.2410E+01 0.4510E+01 0.4330E+01 0.5790E+01 0.6360E+01 0.7180E+01 0.7680E+01 0.7560E+01 0.3080E+01 0.8360E+01
0.8710E+01 0.4620E+01 0.3170E+01 0.2710E+01 0.8020E+01 0.1460E+02 0.2262E+02 0.1709E+02 0.1489E+02 0.4540E+01
0.4450E+01 0.7410E+01 0.7800E+01 0.9400E+01 0.1104E+02 0.3700E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.4690E+01 0.8660E+01 0.6840E+01 0.7480E+01 0.6110E+01
0.4040E+01 0.3740E+01 0.4550E+01 0.5170E+01 0.5820E+01 0.7460E+01 0.7760E+01 0.5890E+01 0.2880E+01 0.8360E+01
0.9200E+01 0.4940E+01 0.5560E+01 0.2490E+01 0.4080E+01 0.4540E+01 0.2103E+02 0.1034E+02 0.7490E+01 0.6220E+01
0.4990E+01 0.6530E+01 0.1015E+02 0.1367E+02 0.1173E+02 0.3100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.1270E+01 0.8730E+01 0.8840E+01 0.5690E+01 0.5470E+01 0.4410E+01
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0.4450E+01 0.4020E+01 0.4960E+01 0.6220E+01 0.6480E+01 0.7190E+01 0.6430E+01 0.7070E+01 0.6160E+01 0.3900E+00
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0.9720E+01 0.1094E+02 0.9150E+01 0.8890E+01 0.4280E+01 0.3800E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.8280E+01 0.7330E+01 0.4080E+01 0.2960E+01 0.3550E+01 0.4830E+01
0.3750E+01 0.4930E+01 0.4690E+01 0.4750E+01 0.6110E+01 0.6300E+01 0.5920E+01 0.7160E+01 0.7470E+01 0.1870E+01
0.2500E+01 0.7740E+01 0.2301E+02 0.3675E+02 0.3814E+02 0.3341E+02 0.3024E+02 0.2513E+02 0.1509E+02 0.1275E+02
0.1090E+02 0.1194E+02 0.9260E+01 0.7880E+01 0.4880E+01 0.4100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.9200E+00 0.1006E+02 0.8180E+01 0.4210E+01 0.2650E+01 0.3280E+01 0.4420E+01
0.2980E+01 0.4550E+01 0.2750E+01 0.4480E+01 0.4090E+01 0.2700E+01 0.3540E+01 0.7480E+01 0.8590E+01 0.7040E+01
0.1180E+01 0.3410E+01 0.2328E+02 0.3659E+02 0.3830E+02 0.4091E+02 0.3999E+02 0.3429E+02 0.2178E+02 0.1758E+02
0.1425E+02 0.1044E+02 0.9390E+01 0.9710E+01 0.7400E+01 0.5900E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.8000E-01 0.8560E+01 0.8870E+01 0.7340E+01 0.3150E+01 0.9700E+00 0.4250E+01
0.3230E+01 0.4890E+01 0.3650E+01 0.3400E+01 0.2790E+01 0.3760E+01 0.3960E+01 0.7310E+01 0.8570E+01 0.3740E+01
0.3030E+01 0.1050E+01 0.2106E+02 0.3381E+02 0.3667E+02 0.3926E+02 0.3837E+02 0.2735E+02 0.2154E+02 0.1641E+02
0.1370E+02 0.1020E+02 0.9920E+01 0.8550E+01 0.6490E+01 0.3800E+00
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0.3340E+01 0.4920E+01 0.3740E+01 0.4200E+01 0.4140E+01 0.4800E+01 0.7330E+01 0.7710E+01 0.8340E+01 0.9280E+01
0.3610E+01 0.1142E+02 0.9190E+01 0.3423E+02 0.3655E+02 0.3714E+02 0.3481E+02 0.3369E+02 0.2524E+02 0.1906E+02
0.1418E+02 0.6420E+01 0.8490E+01 0.6790E+01 0.7090E+01 0.2100E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.4090E+01 0.8900E+01 0.9030E+01 0.8980E+01 0.7050E+01 0.5310E+01 0.3560E+01
0.2500E+01 0.4450E+01 0.4900E+01 0.3510E+01 0.3260E+01 0.5690E+01 0.7270E+01 0.7750E+01 0.7920E+01 0.9170E+01

0.9040E+01	0.7930E+01	0.1149E+02	0.3351E+02	0.3617E+02	0.3619E+02	0.3146E+02	0.3333E+02	0.2809E+02	0.1881E+02
0.1329E+02	0.9690E+01	0.9920E+01	0.8850E+01	0.7980E+01	0.2800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.2460E+01	0.6680E+01	0.8580E+01	0.8930E+01	0.9370E+01	0.8550E+01	0.7840E+01
0.7380E+01	0.4030E+01	0.4050E+01	0.2920E+01	0.4020E+01	0.5380E+01	0.6690E+01	0.7520E+01	0.7590E+01	0.7860E+01
0.8560E+01	0.5740E+01	0.1247E+02	0.3591E+02	0.3624E+02	0.3400E+02	0.3189E+02	0.3058E+02	0.2275E+02	0.1243E+02
0.1668E+02	0.1573E+02	0.1131E+02	0.8050E+01	0.5860E+01	0.6000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.4600E+00	0.5130E+01	0.8490E+01	0.8860E+01	0.8800E+01	0.8080E+01
0.7570E+01	0.6520E+01	0.3110E+01	0.2300E+01	0.2900E+01	0.2480E+01	0.3790E+01	0.4580E+01	0.4380E+01	0.7760E+01
0.7000E+01	0.4010E+01	0.2380E+02	0.3314E+02	0.3442E+02	0.3402E+02	0.3649E+02	0.3057E+02	0.1934E+02	0.1442E+02
0.1067E+02	0.5070E+01	0.6900E+01	0.7490E+01	0.5080E+01	0.3000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3430E+01	0.8380E+01	0.8790E+01	0.8830E+01
0.8210E+01	0.8120E+01	0.8030E+01	0.4150E+01	0.2670E+01	0.2240E+01	0.2850E+01	0.3890E+01	0.4790E+01	0.5350E+01
0.3750E+01	0.2060E+01	0.2456E+02	0.3025E+02	0.3041E+02	0.3914E+02	0.3447E+02	0.2537E+02	0.1370E+02	0.1066E+02
0.8120E+01	0.1108E+02	0.1132E+02	0.1017E+02	0.2890E+01	0.2800E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3370E+01	0.8390E+01	0.8800E+01
0.9060E+01	0.9050E+01	0.8440E+01	0.7610E+01	0.4460E+01	0.5920E+01	0.3400E+01	0.2020E+01	0.1730E+01	0.3240E+01
0.3250E+01	0.4570E+01	0.1840E+02	0.2458E+02	0.2889E+02	0.3997E+02	0.3254E+02	0.2007E+02	0.8720E+01	0.6530E+01
0.7960E+01	0.9430E+01	0.7230E+01	0.7650E+01	0.5280E+01	0.5000E-01				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.2720E+01	0.7900E+01
0.9020E+01	0.8930E+01	0.8750E+01	0.8760E+01	0.8960E+01	0.8630E+01	0.8950E+01	0.4690E+01	0.1380E+01	0.9700E+00
0.5580E+01	0.5740E+01	0.1250E+02	0.1993E+02	0.2221E+02	0.3610E+02	0.2649E+02	0.6650E+01	0.9920E+01	0.4690E+01
0.2280E+01	0.4590E+01	0.7660E+01	0.8180E+01	0.2800E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.3300E+00
0.7110E+01	0.8370E+01	0.8680E+01	0.9030E+01	0.9210E+01	0.1075E+02	0.1504E+02	0.1157E+02	0.3900E+01	0.7060E+01
0.6510E+01	0.4160E+01	0.2361E+02	0.3442E+02	0.3009E+02	0.2575E+02	0.1663E+02	0.7960E+01	0.1008E+02	0.9330E+01
0.5570E+01	0.7820E+01	0.8120E+01	0.7670E+01	0.1310E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.1280E+01	0.6230E+01	0.8000E+01	0.8850E+01	0.9550E+01	0.1019E+02	0.1039E+02	0.9730E+01	0.8220E+01	0.8320E+01
0.7090E+01	0.8880E+01	0.1234E+02	0.1692E+02	0.1285E+02	0.1343E+02	0.1162E+02	0.1097E+02	0.9670E+01	0.1058E+02
0.8940E+01	0.8400E+01	0.7920E+01	0.5980E+01	0.1300E+01	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.3220E+01	0.7570E+01	0.9110E+01	0.9480E+01	0.8470E+01	0.7700E+01	0.8230E+01	0.7950E+01
0.9270E+01	0.8420E+01	0.8870E+01	0.1086E+02	0.8850E+01	0.9970E+01	0.9190E+01	0.7310E+01	0.1084E+02	0.8130E+01
0.8830E+01	0.8170E+01	0.7840E+01	0.4650E+01	0.2900E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.2590E+01	0.3570E+01	0.3310E+01	0.9020E+01	0.8730E+01	0.9230E+01	0.9630E+01	0.9170E+01
0.1282E+02	0.8510E+01	0.9270E+01	0.1011E+02	0.8720E+01	0.9060E+01	0.1021E+02	0.7700E+01	0.1047E+02	0.8280E+01
0.6980E+01	0.7630E+01	0.5790E+01	0.1260E+01	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.8000E-01	0.1710E+01	0.2820E+01	0.3720E+01	0.7760E+01	0.9090E+01
0.1202E+02	0.9350E+01	0.8360E+01	0.9060E+01	0.7420E+01	0.8140E+01	0.9010E+01	0.8430E+01	0.7860E+01	0.8290E+01
0.7050E+01	0.3570E+01	0.1500E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.1100E+00	0.1710E+01
0.5360E+01	0.8760E+01	0.8220E+01	0.8720E+01	0.8870E+01	0.8380E+01	0.5640E+01	0.1380E+01	0.1570E+01	0.7500E+00
0.6600E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.2400E+00	0.4220E+01	0.6470E+01	0.4810E+01	0.3970E+01	0.8300E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
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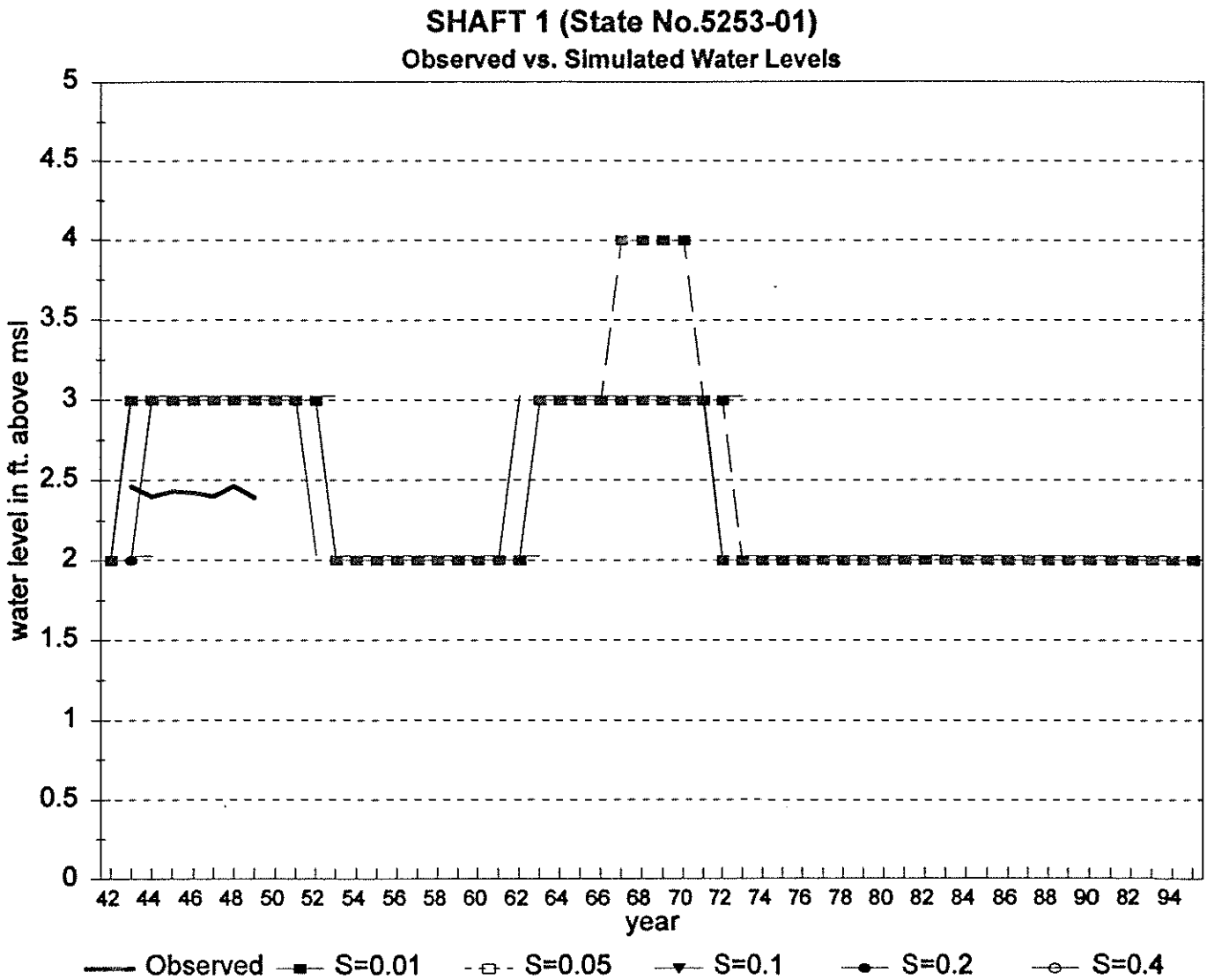
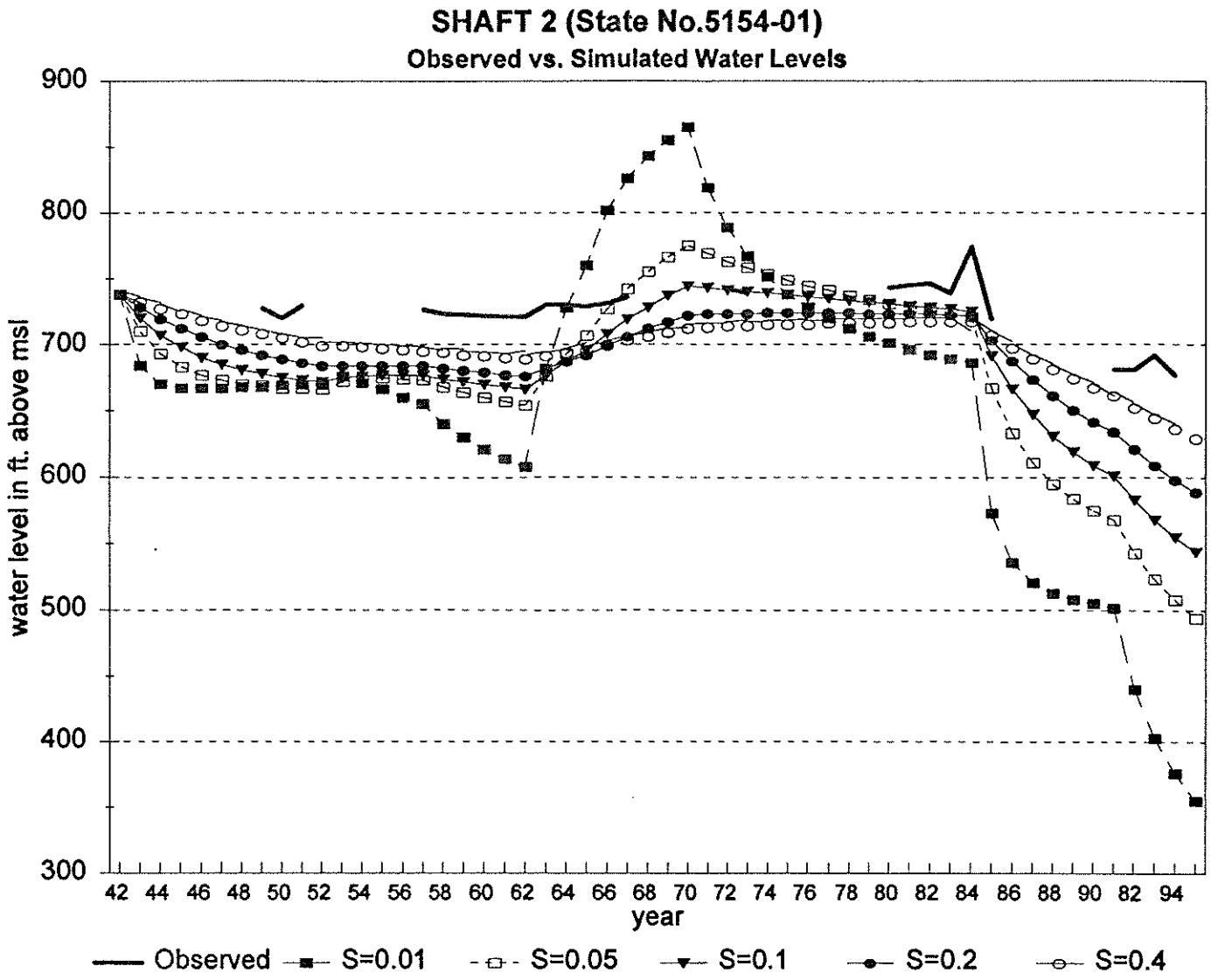
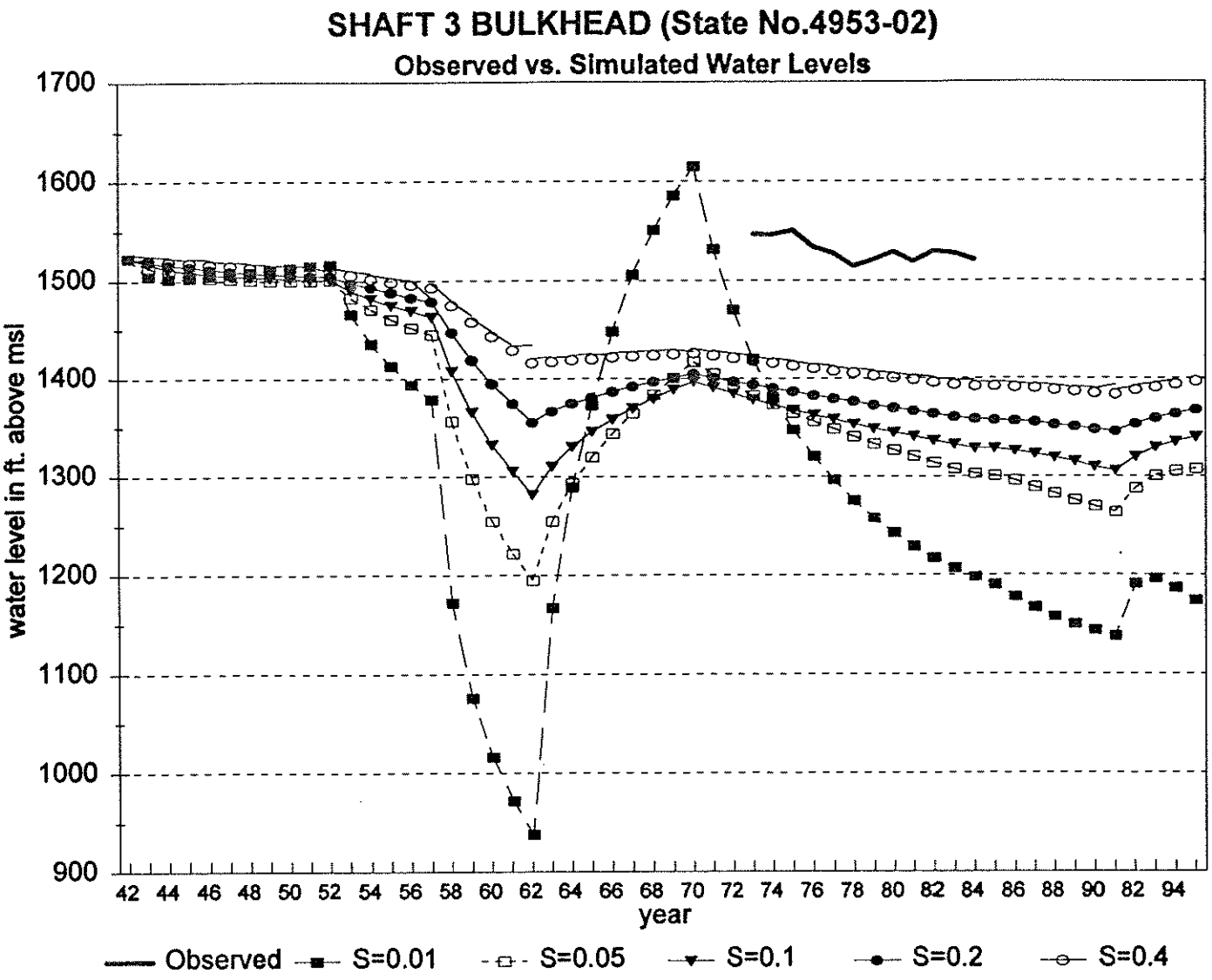
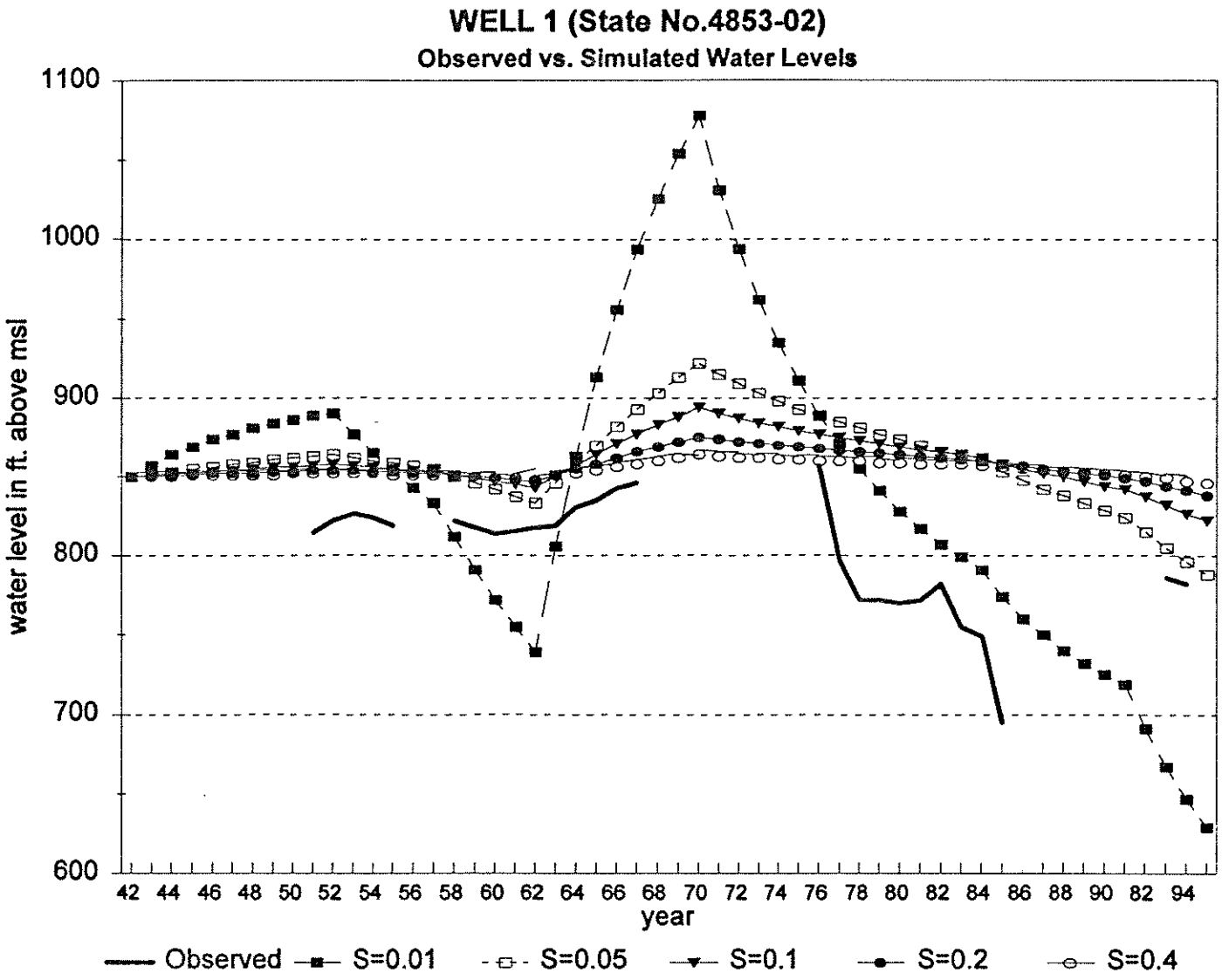
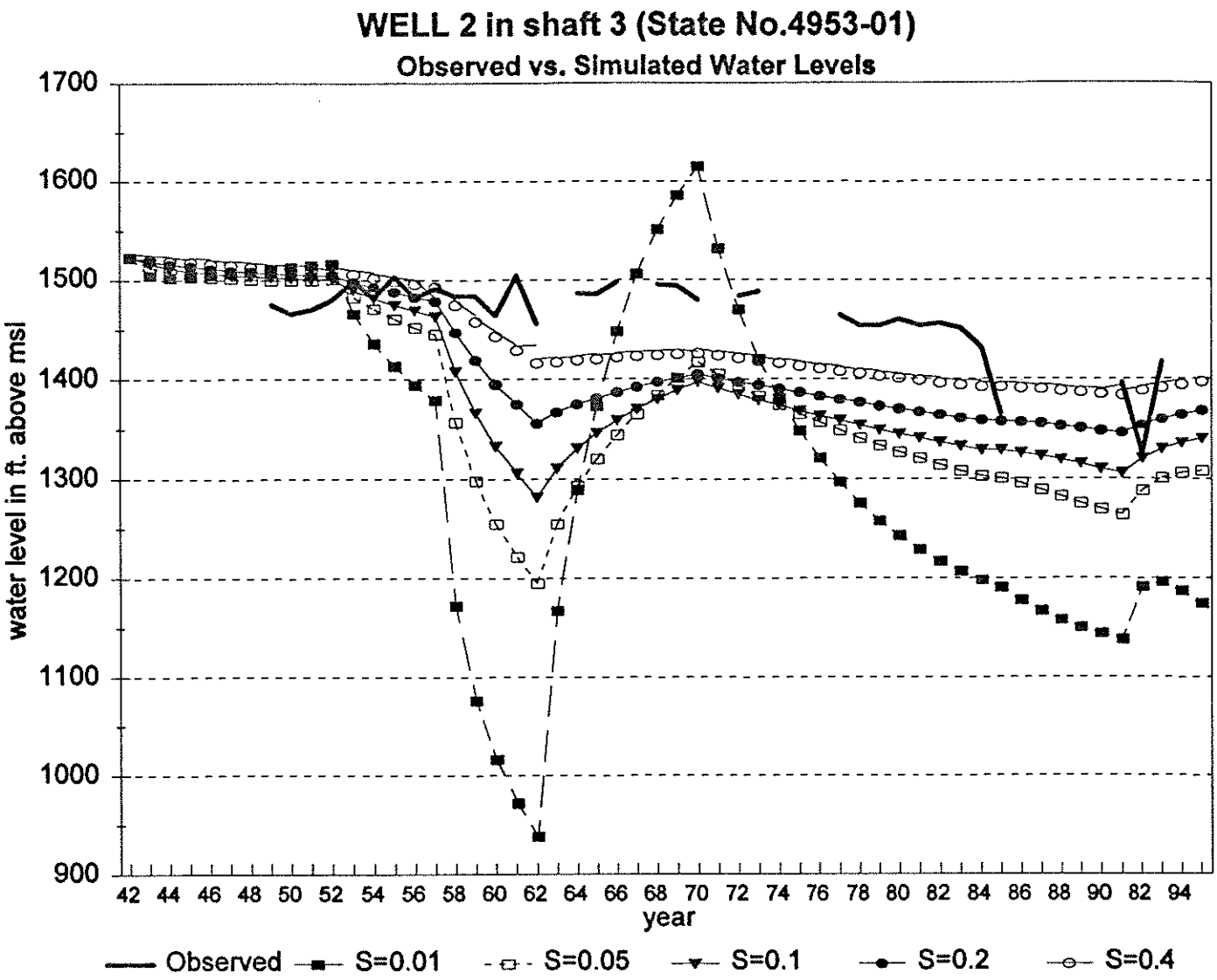
APPENDIX F

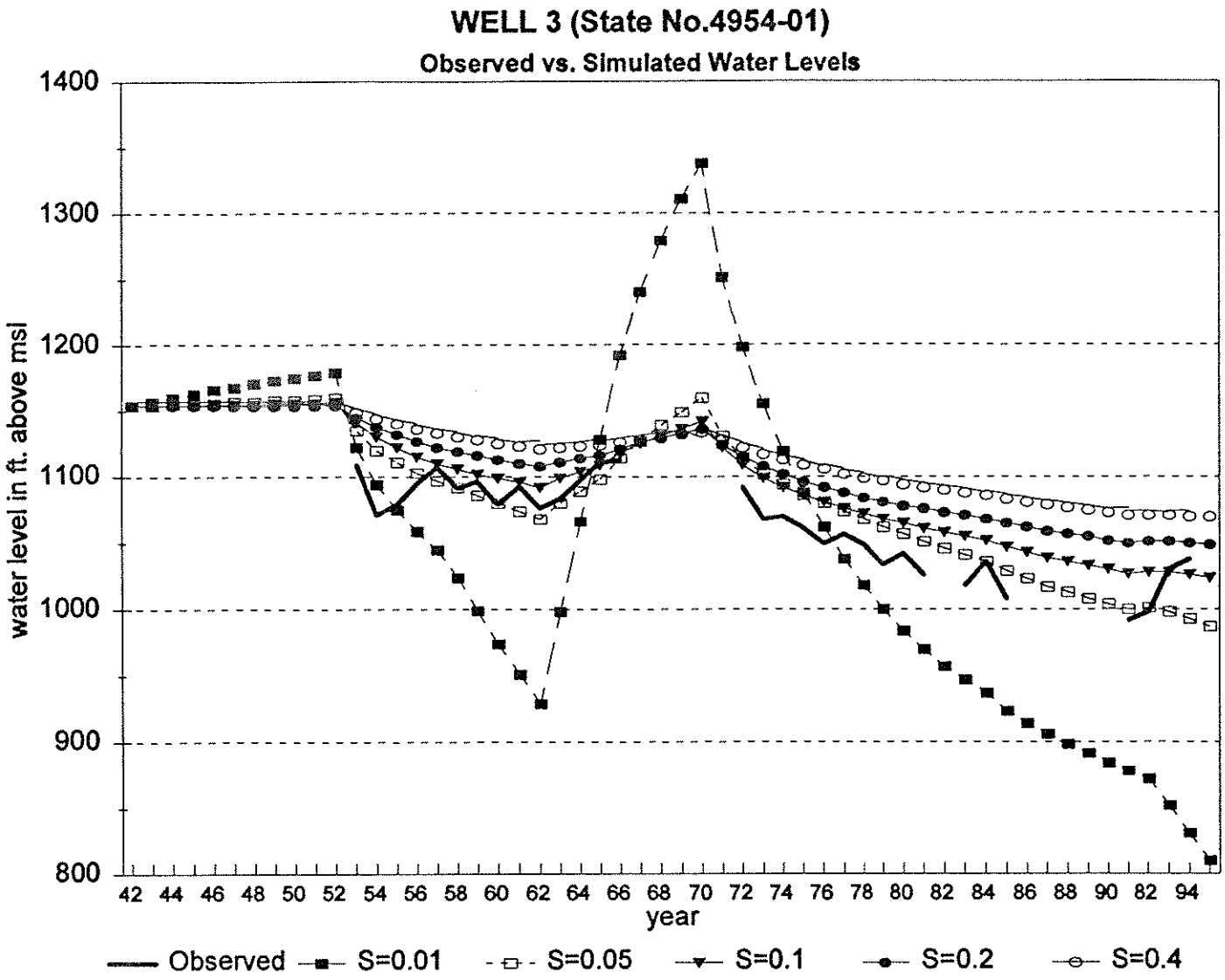

SHAFT 1 (State No.5253-01)
Observed vs. Simulated Water Levels
water level in ft. above msl
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

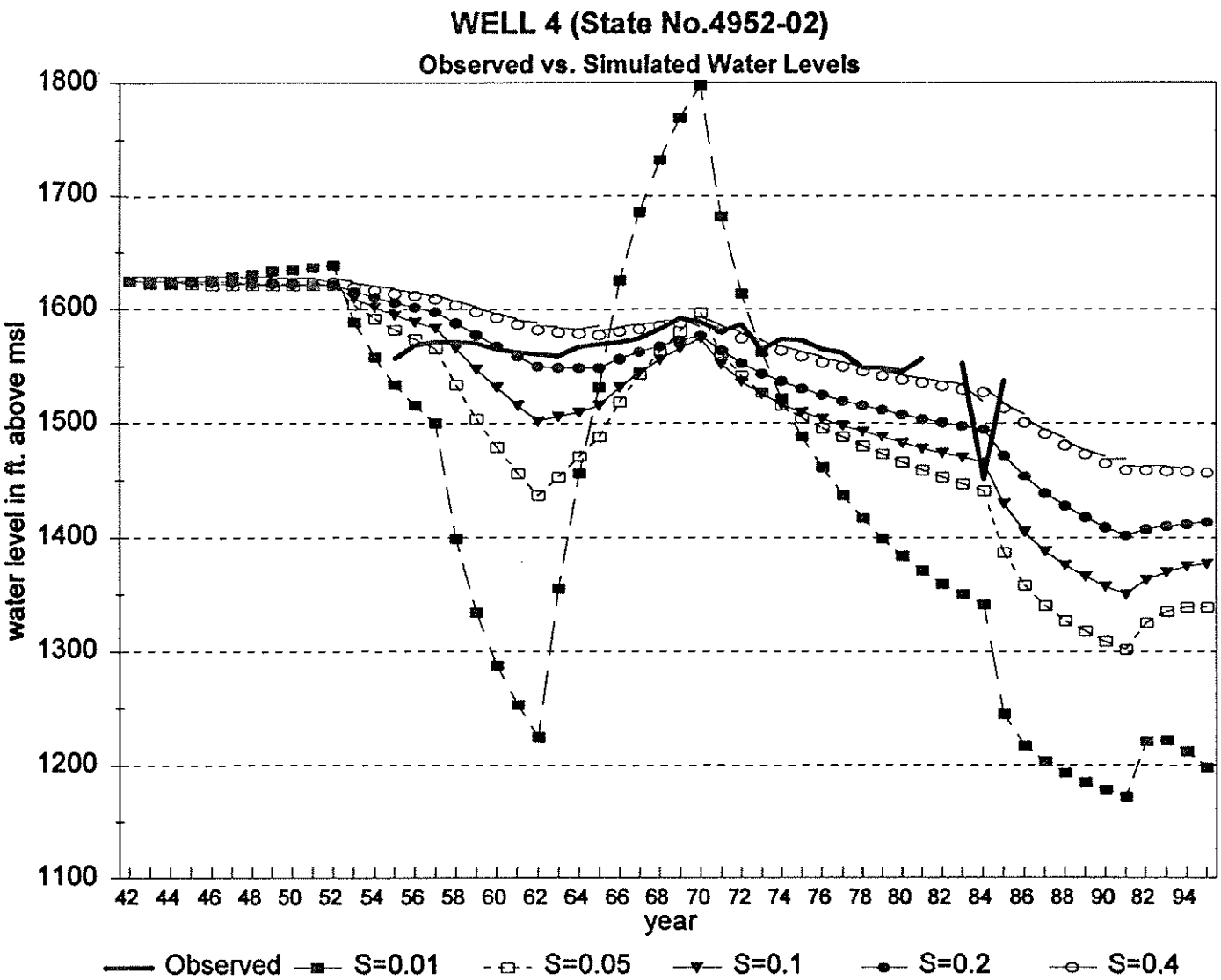

SHAFT 2 (State No.5154-01)
Observed vs. Simulated Water Levels
water level in ft. above msl
900
800
700
600
500
400
300
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

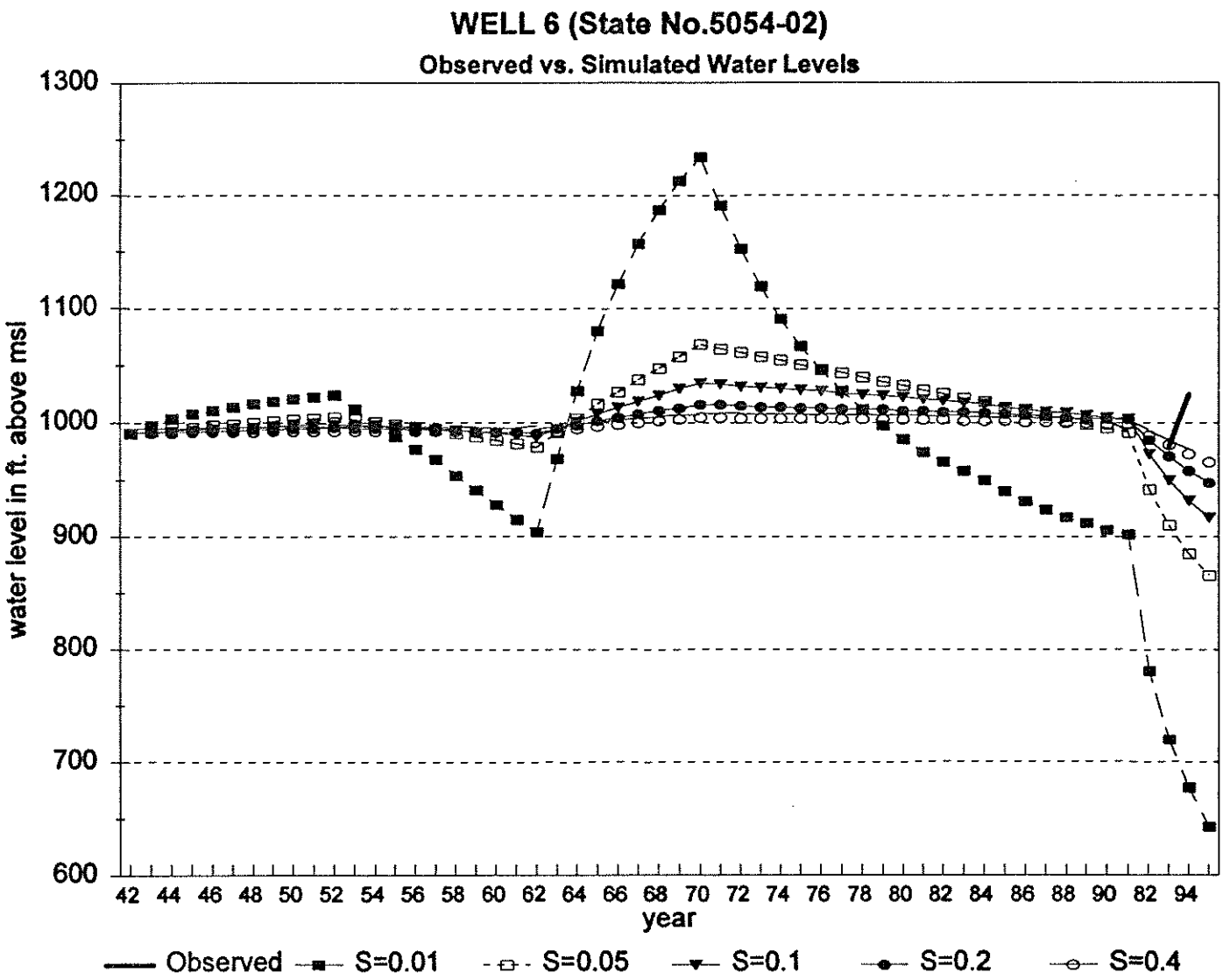

SHAFT 3 BULKHEAD (State No.4953-02)
Observed vs. Simulated Water Levels
water level in ft. above msl
1700
1600
1500
1400
1300
1200
1100
1000
900
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

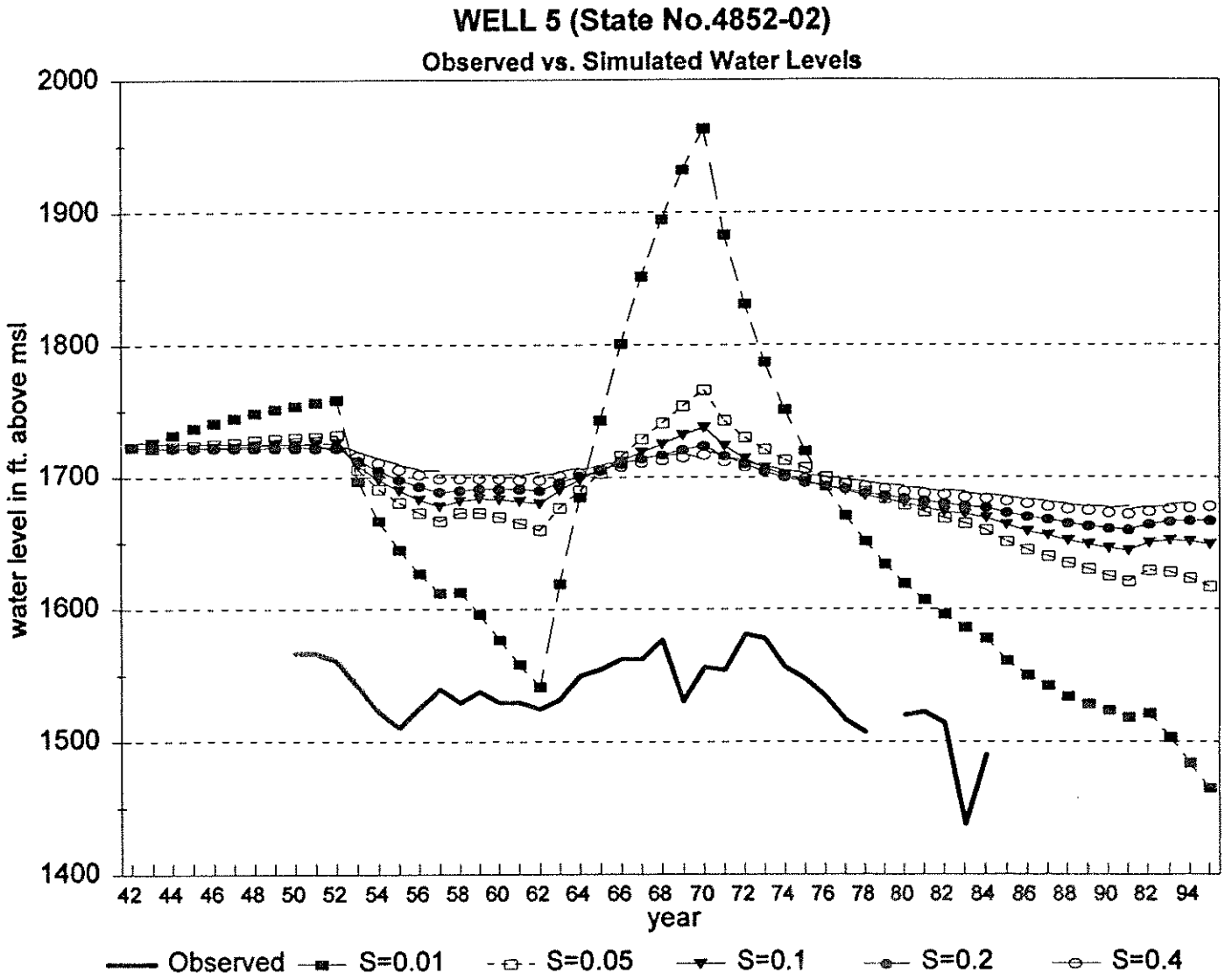

WELL 1 (State No.4853-02)
Observed vs. Simulated Water Levels
1100
1000
900
800
700
600
water level in ft. above msl
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

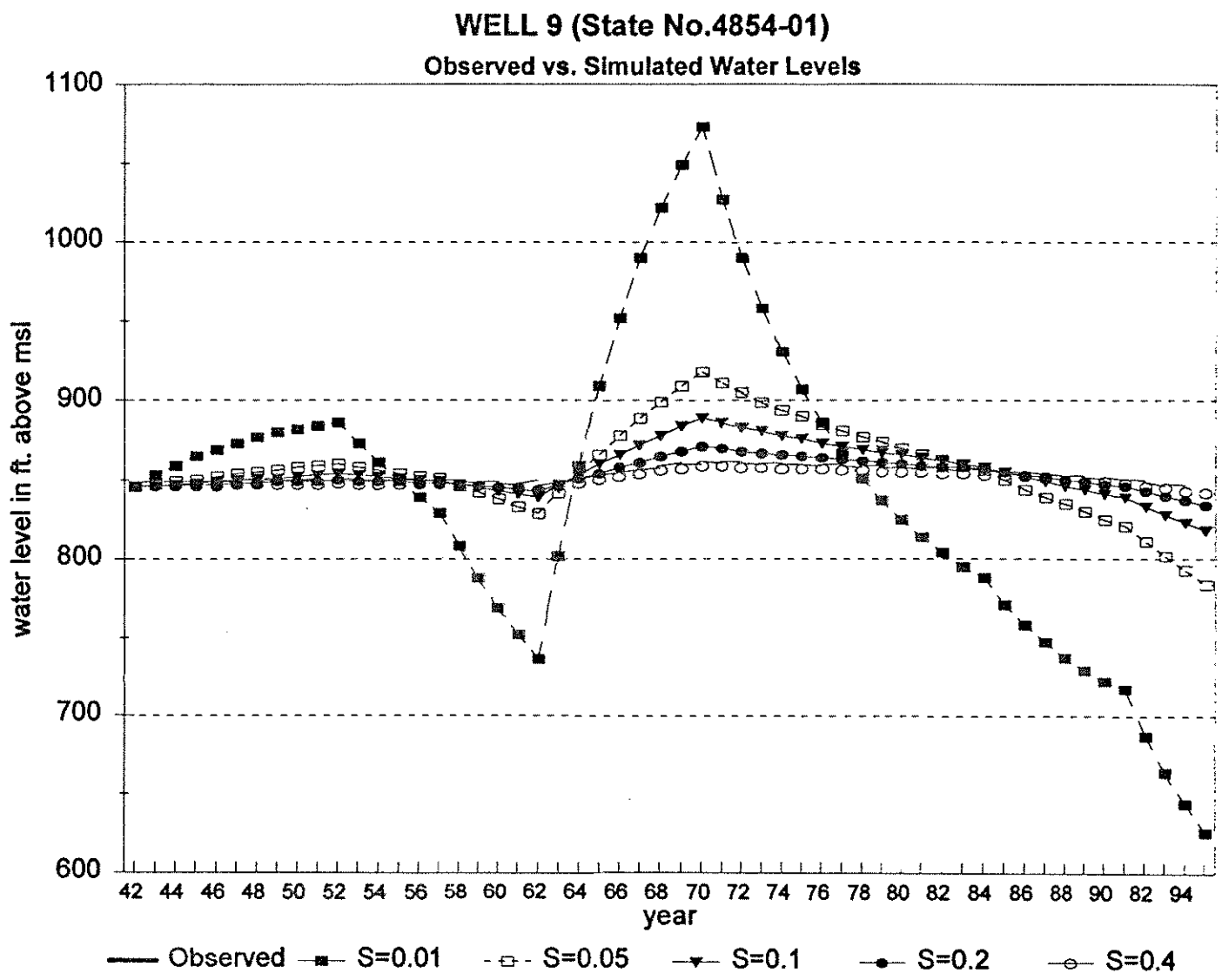

WELL 2 in shaft 3 (State No.4953-01)
Observed vs. Simulated Water Levels
water level in ft. above msl
1700
1600
1500
1400
1300
1200
1100
1000
900
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4


WELL 3 (State No.4954-01)
Observed vs. Simulated Water Levels
1400
1300
1200
1100
1000
900
800
water level in ft. above msl
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4


WELL 4 (State No.4952-02)
Observed vs. Simulated Water Levels
water level in ft. above msl
1800
1700
1600
1500
1400
1300
1200
1100
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4


WELL 6 (State No.5054-02)
Observed vs. Simulated Water Levels
water level in ft. above msl
1300
1200
1100
1000
900
800
700
600
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

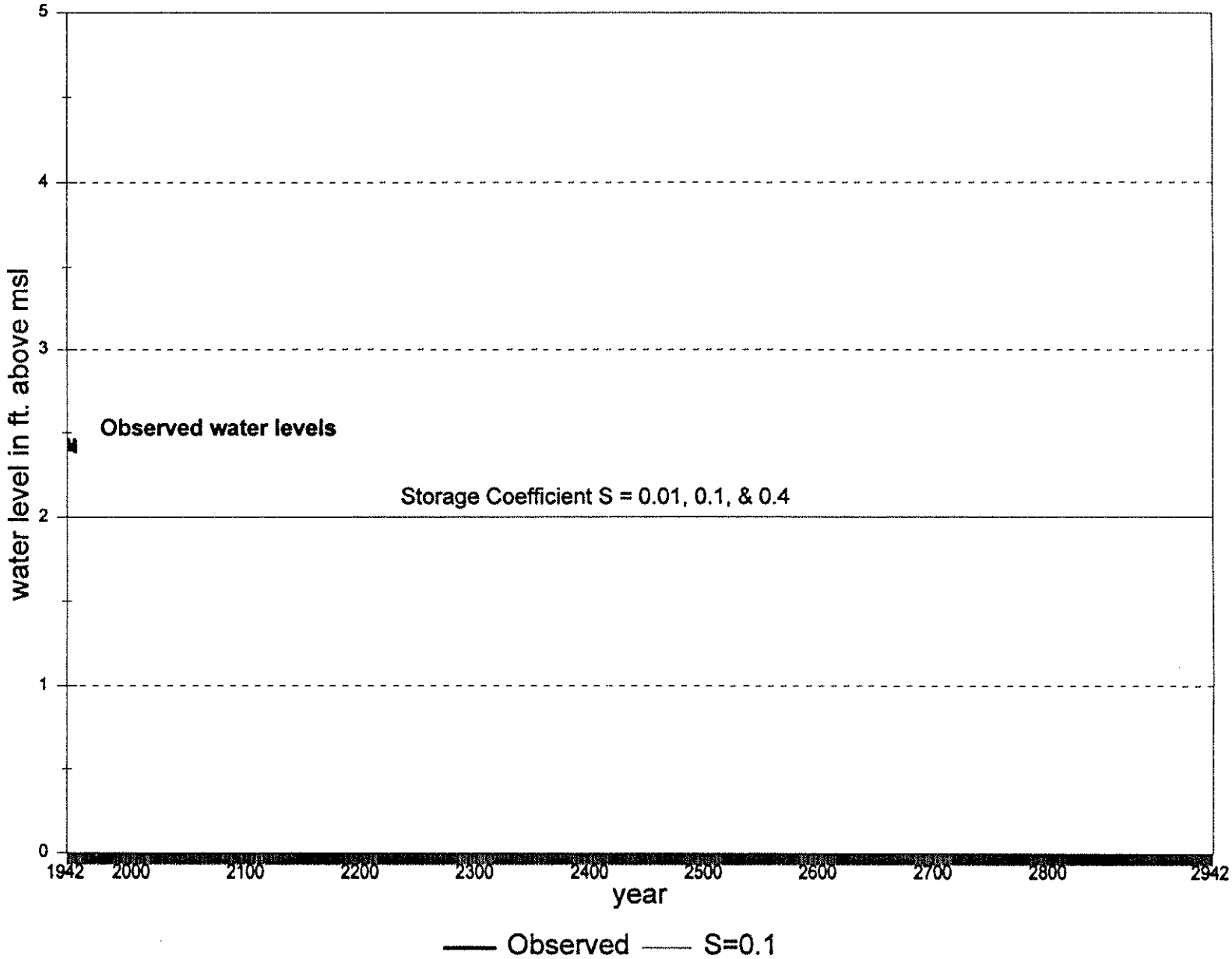

WELL 5 (State No.4852-02)
Observed vs. Simulated Water Levels
2000
1900
1800
1700
1600
1500
1400
water level in ft. above msl
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4


WELL 9 (State No.4854-01)
Observed vs. Simulated Water Levels
1100
1000
900
800
700
600
water level in ft. above msl
42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 82 94
year
Observed
S=0.01
S=0.05
S=0.1
S=0.2
S=0.4

APPENDIX G

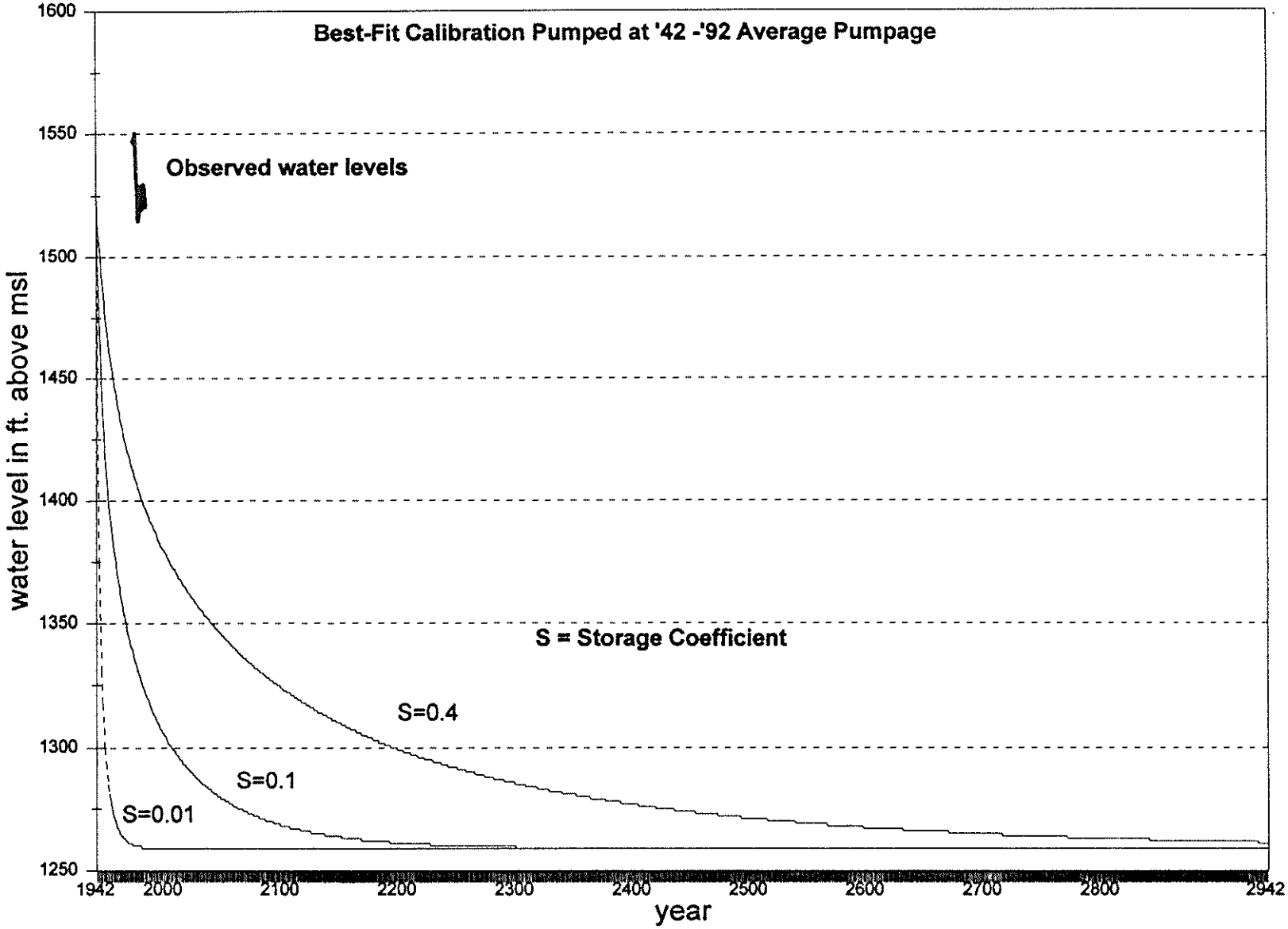
SHAFT 1 (State No.5253-01)

Observed vs. Transient Simulated W.L.



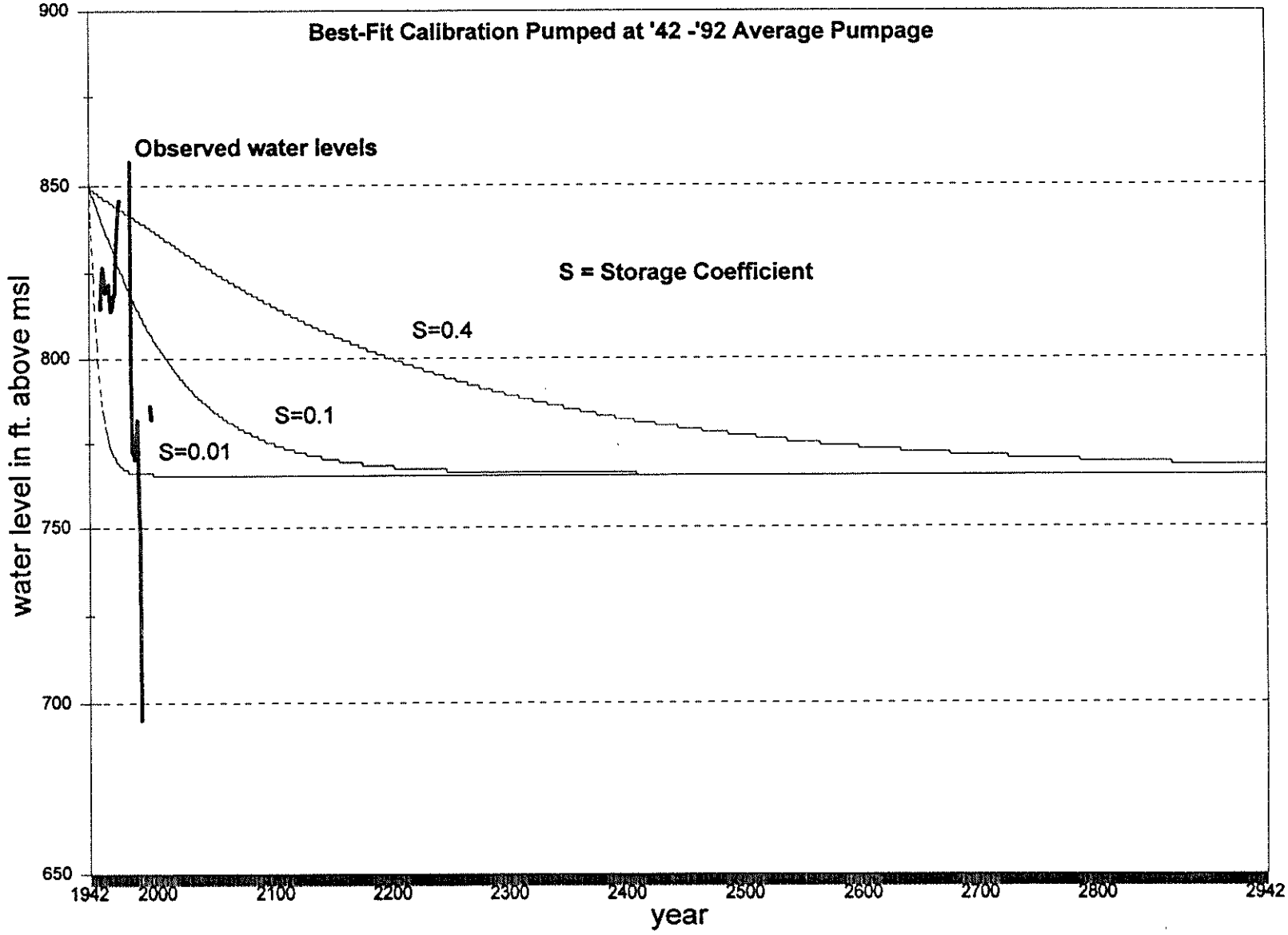
SHAFT 3 BULKHEAD (State No.4953-02)

Observed vs. Simulated Transient W.L.



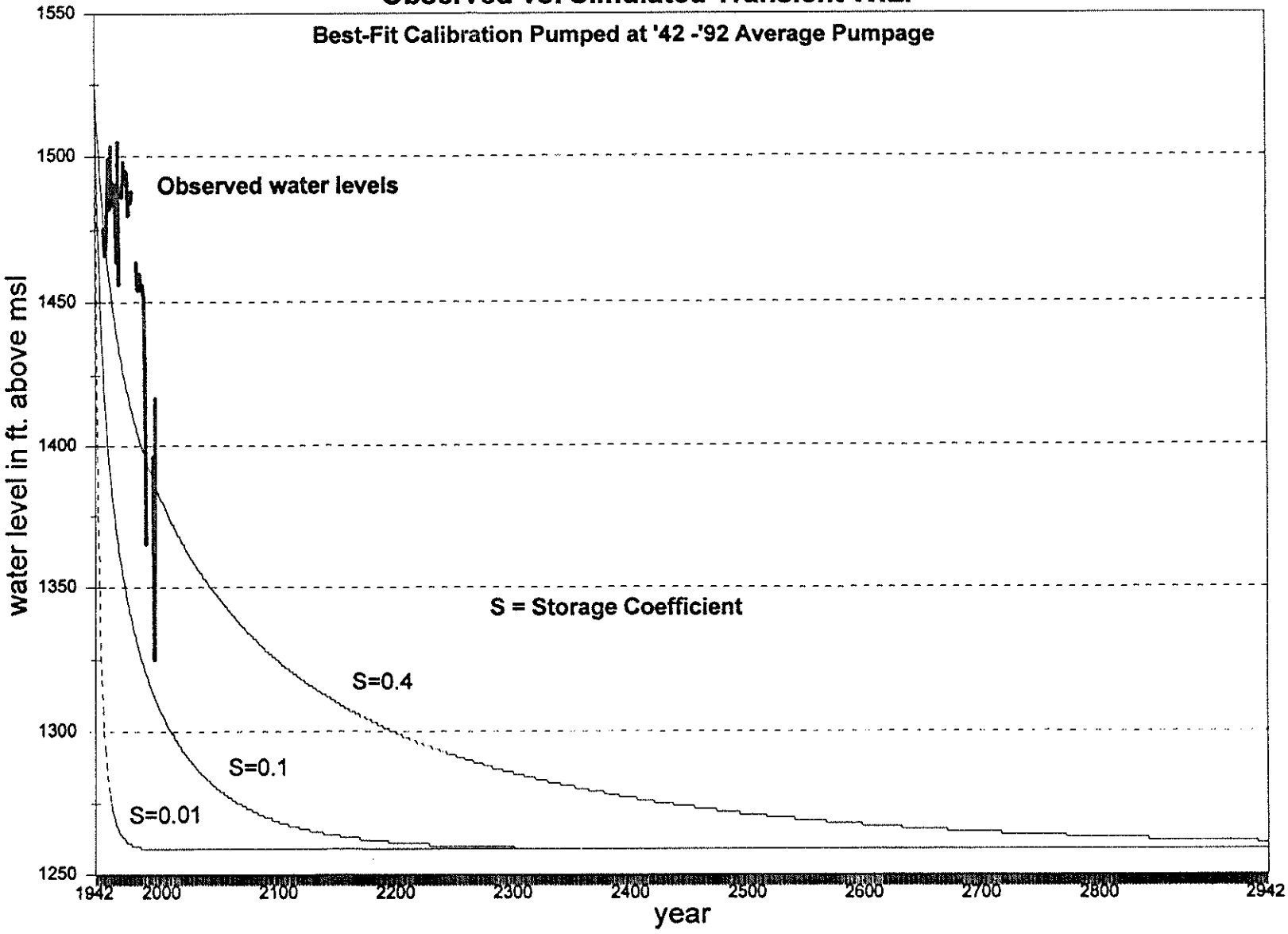
WELL 1 (State No.4853-02)

Observed vs. Simulated Transient W.L.



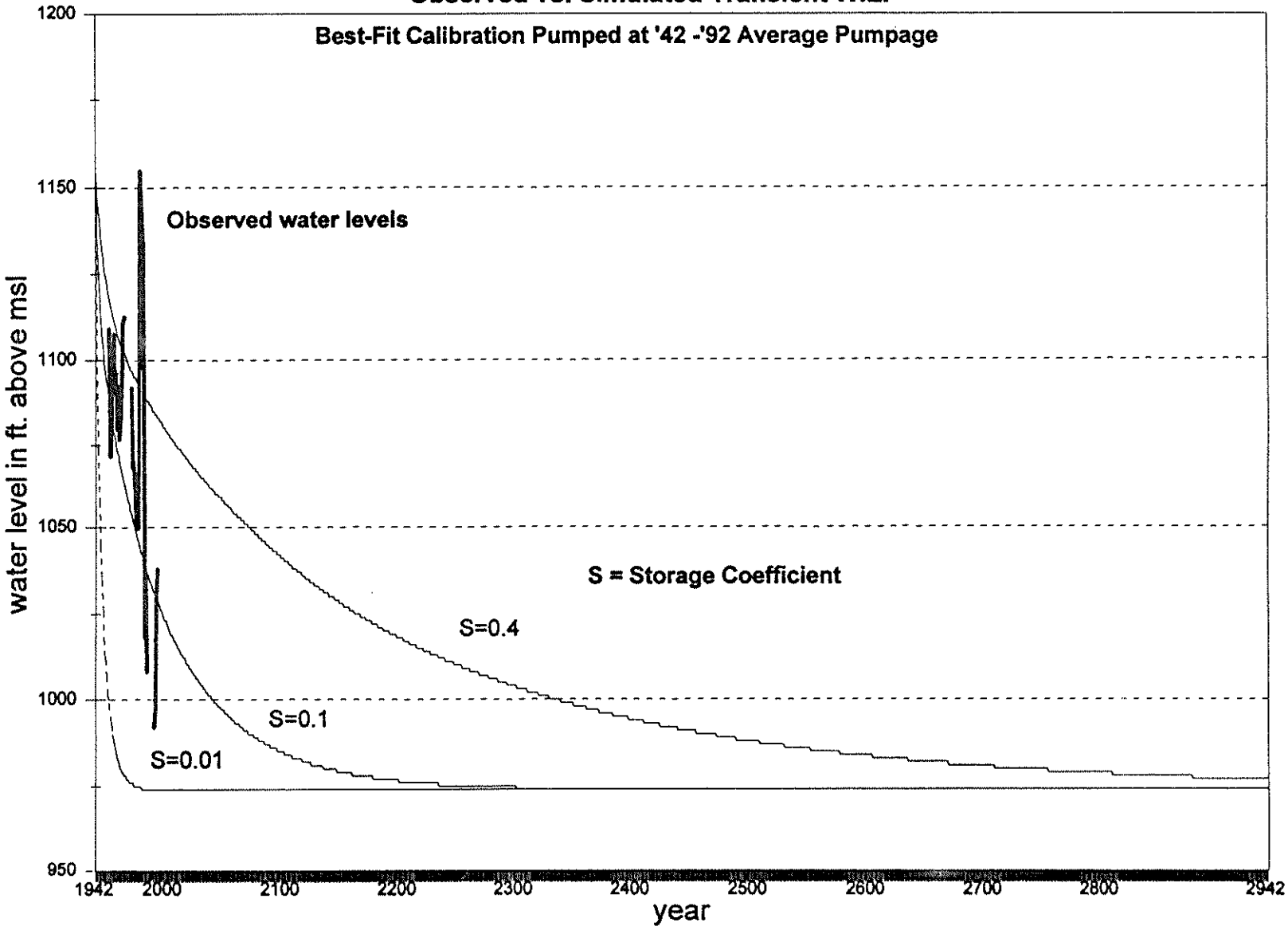
WELL 2 in shaft 3 (State No.4953-01)

Observed vs. Simulated Transient W.L.



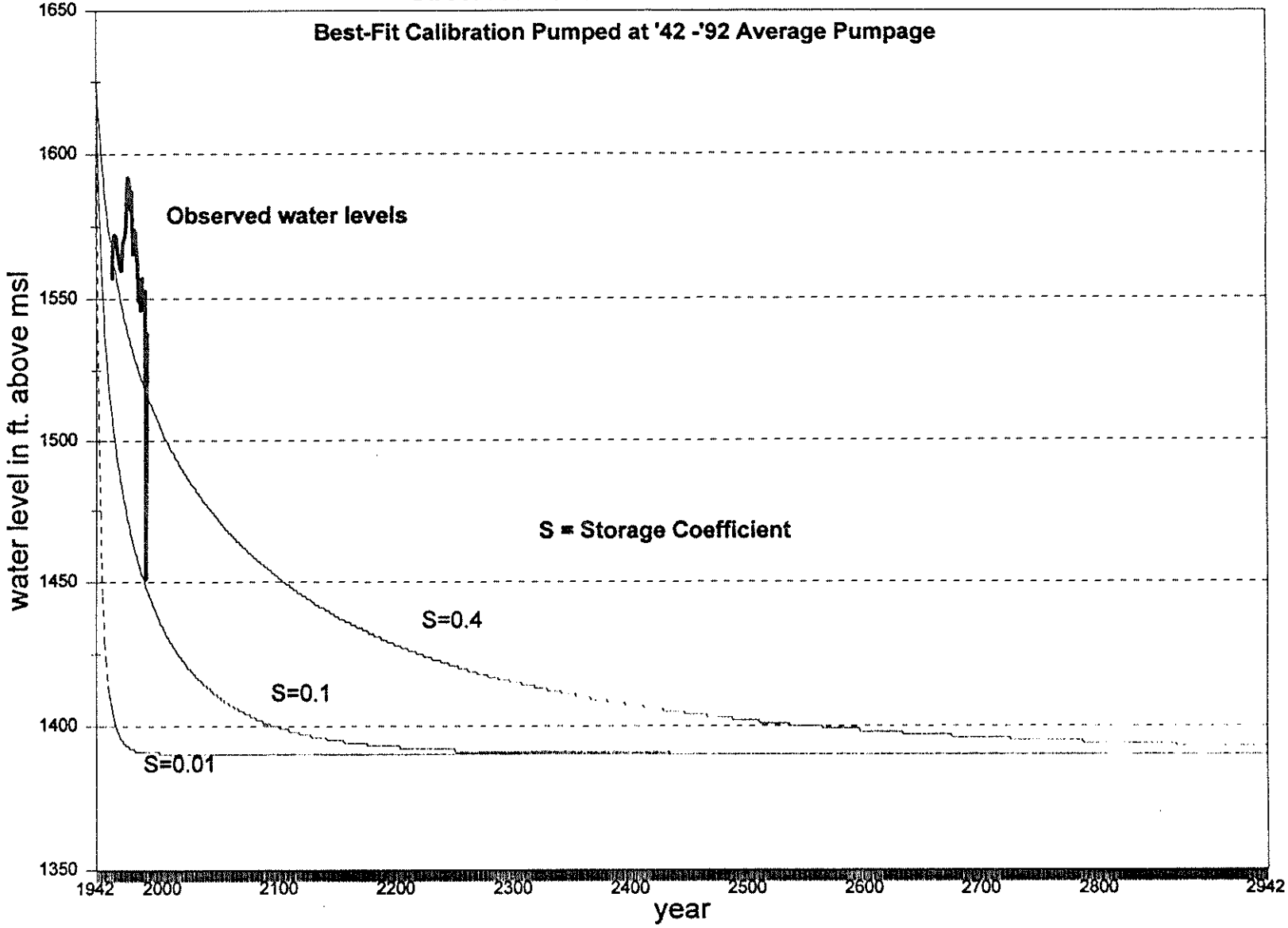
WELL 3 (State No.4954-01)

Observed vs. Simulated Transient W.L.



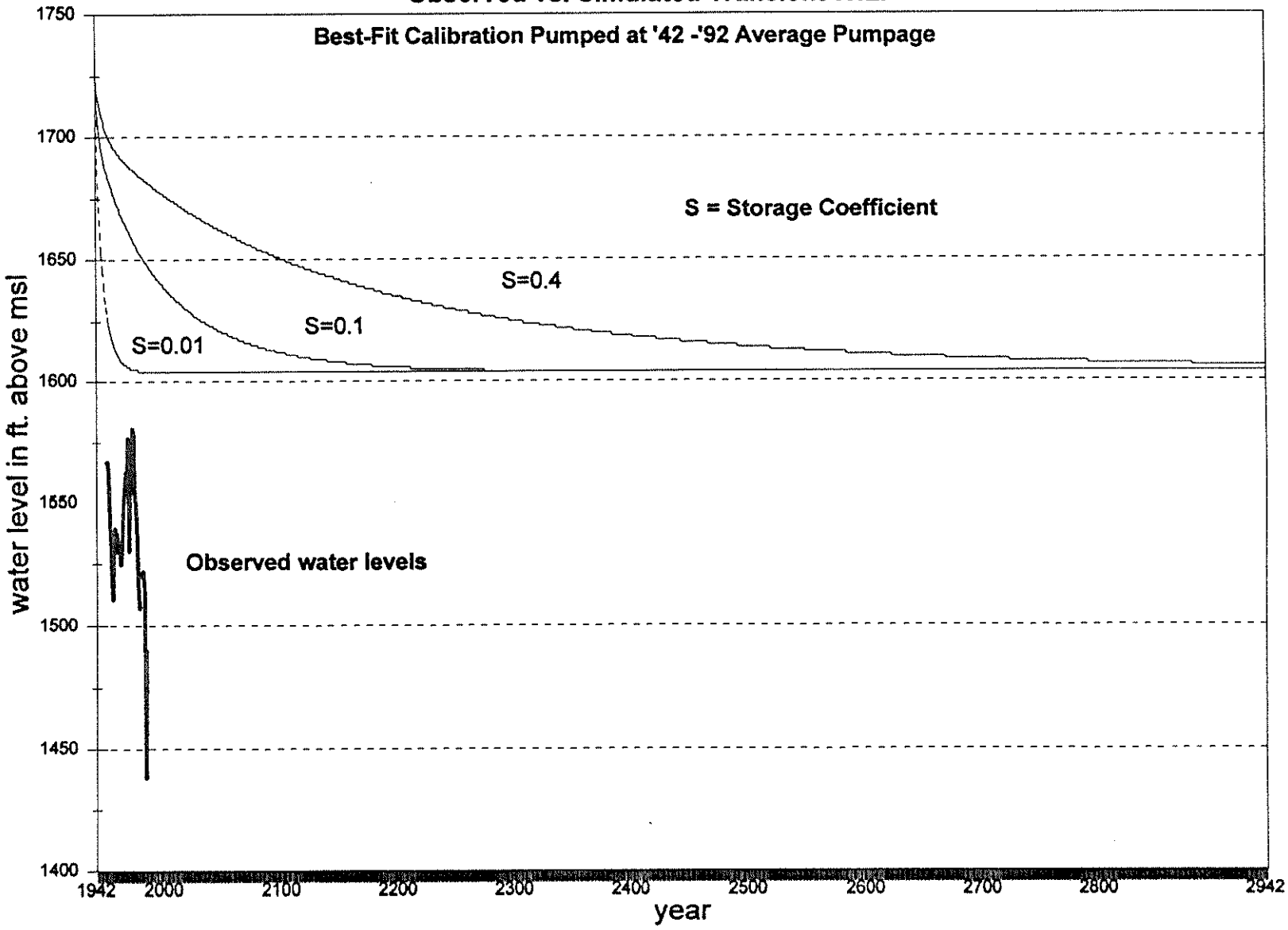
WELL 4 (State No.4952-02)

Observed vs. Simulated Transient W.L.



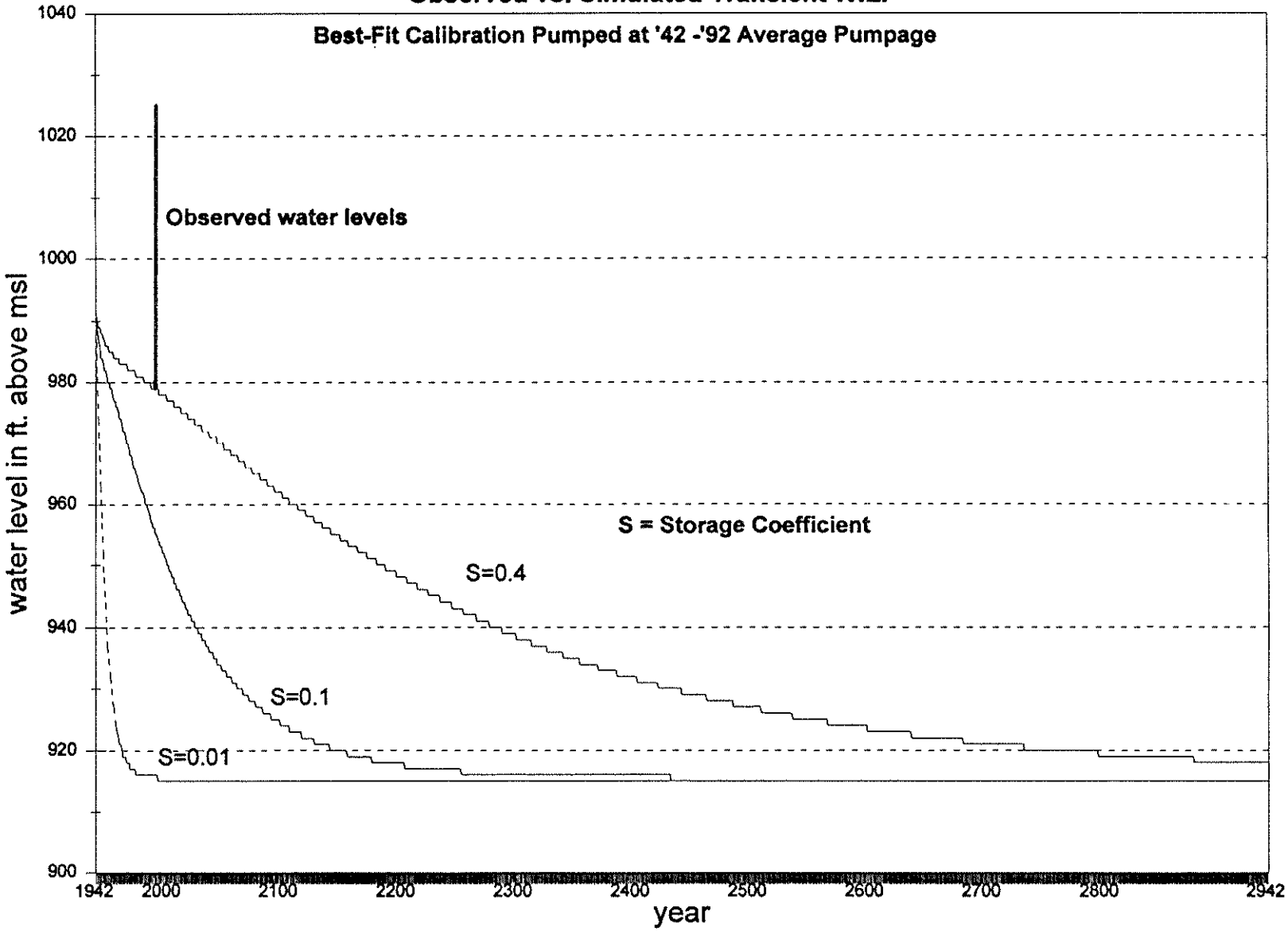
WELL 5 (State No.4852-02)

Observed vs. Simulated Transient W.L.



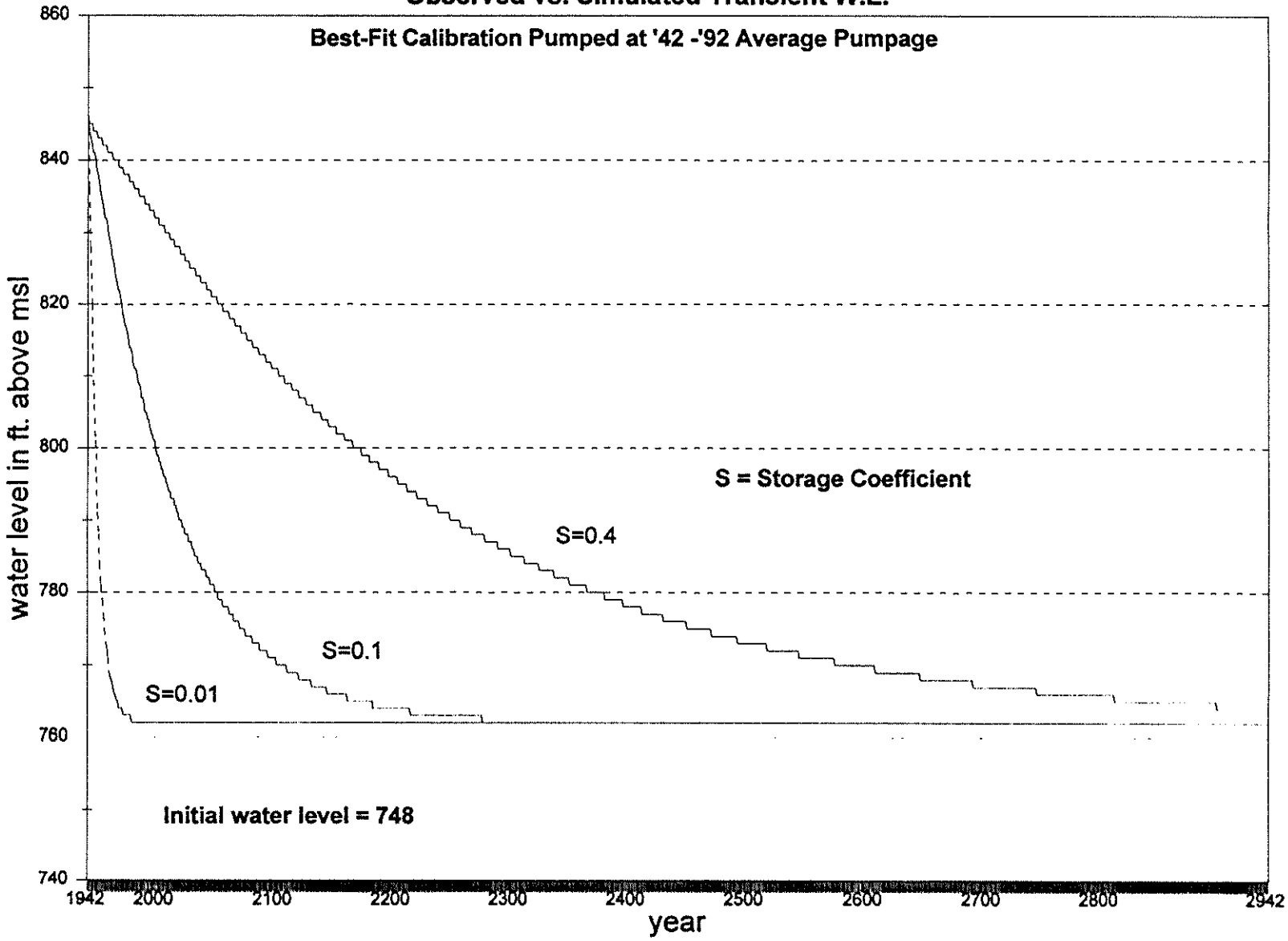
WELL 6 (State No.5054-02)

Observed vs. Simulated Transient W.L.

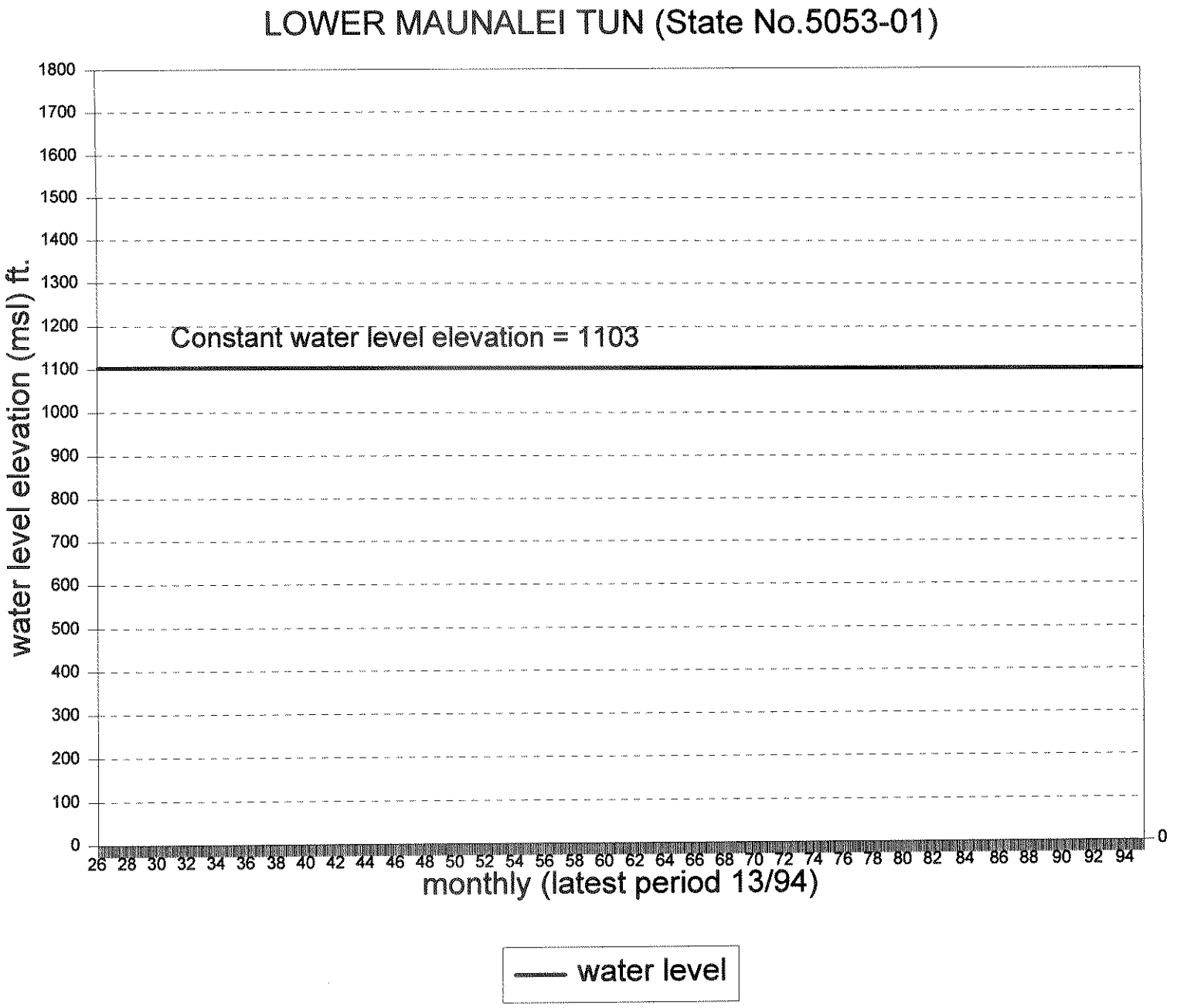


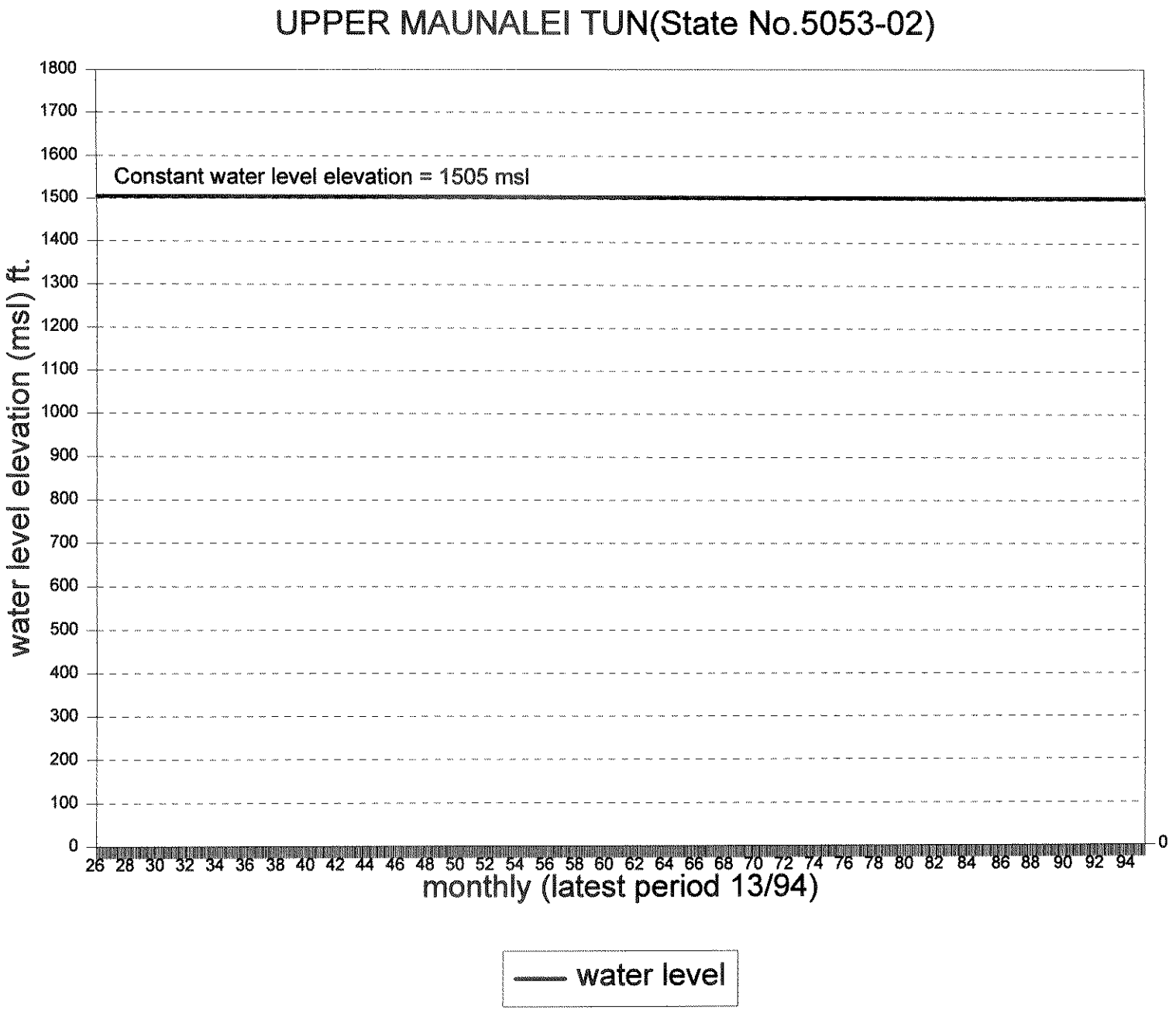
WELL 9 (State No.4854-01)

Observed vs. Simulated Transient W.L.

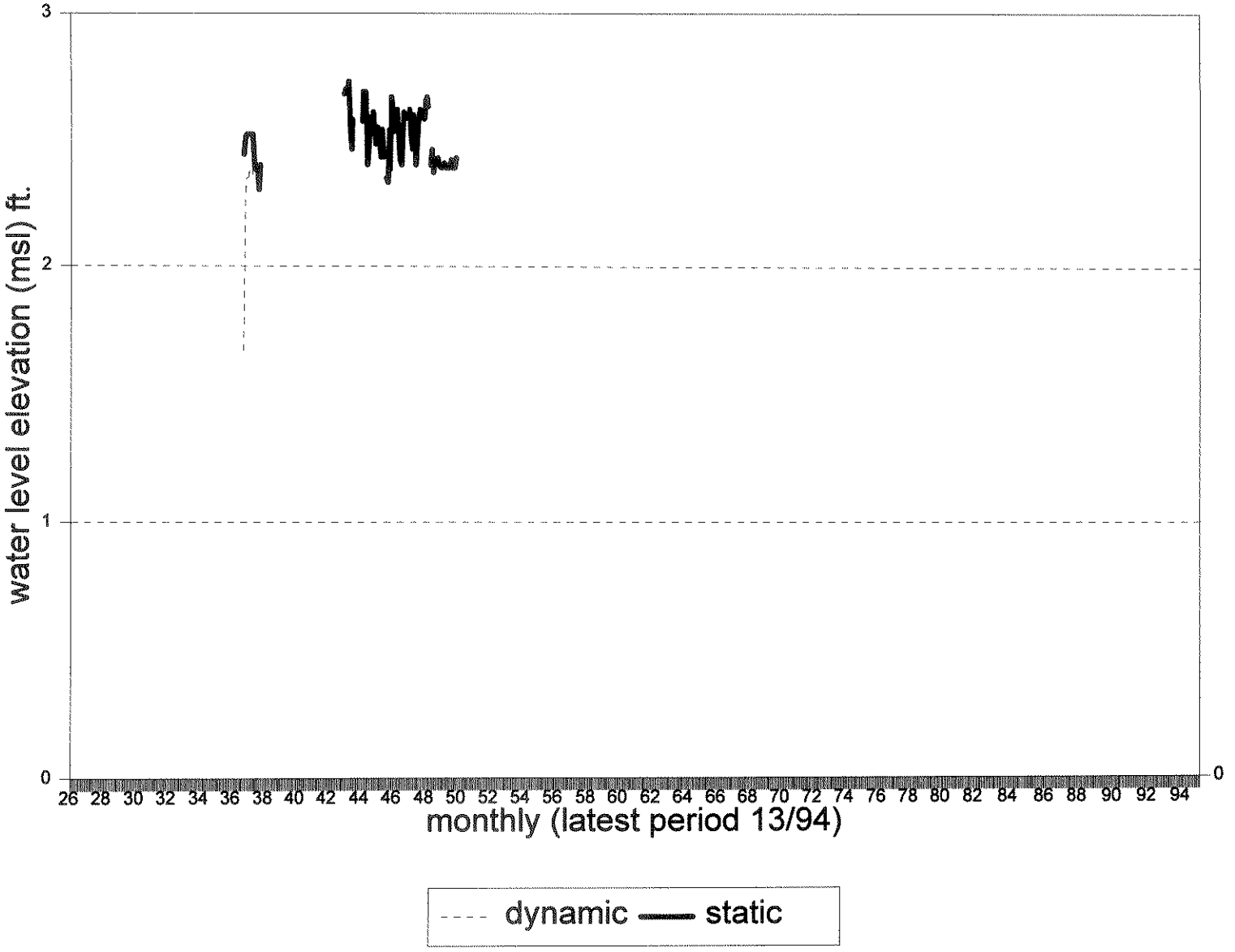


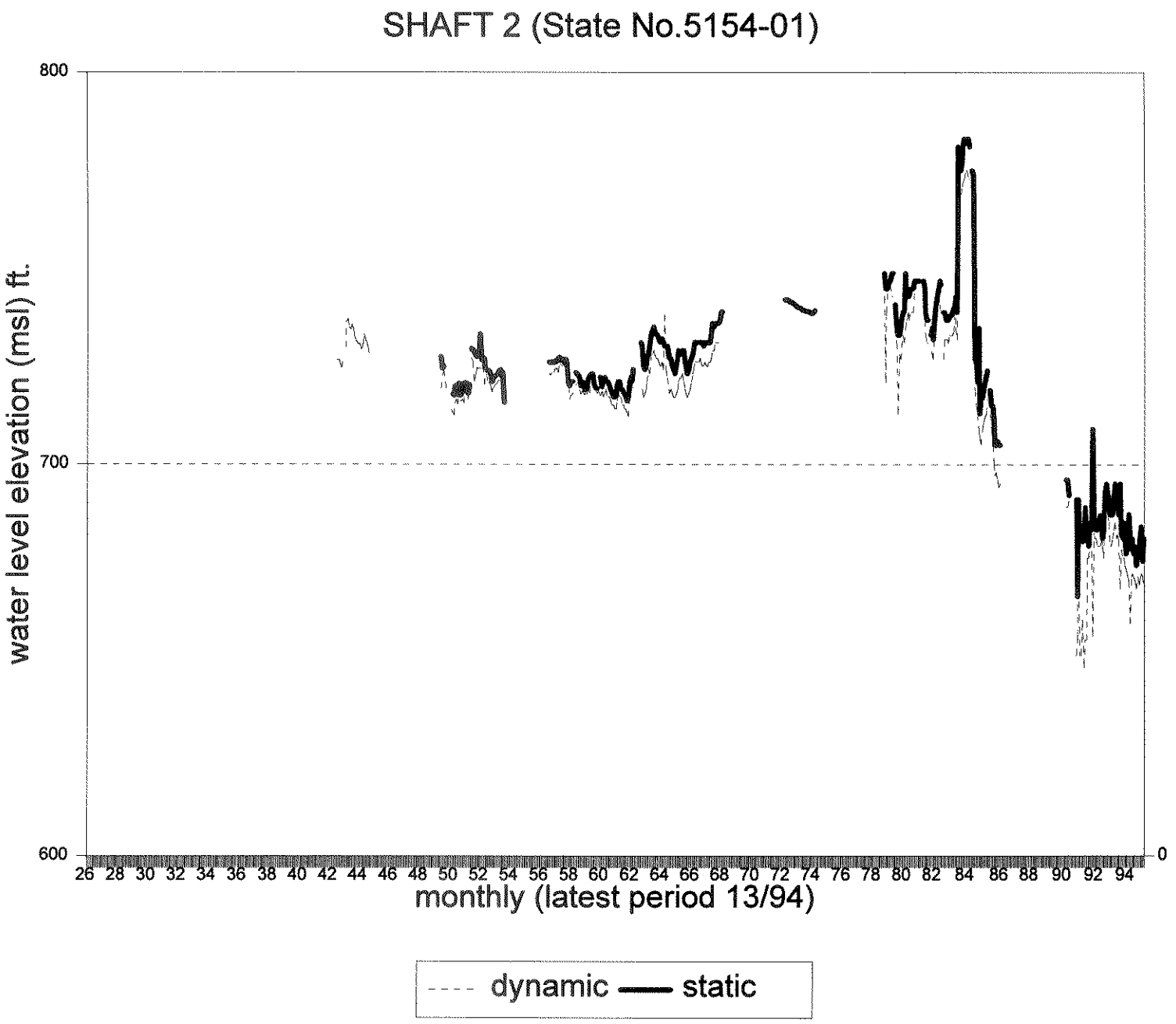
APPENDIX H

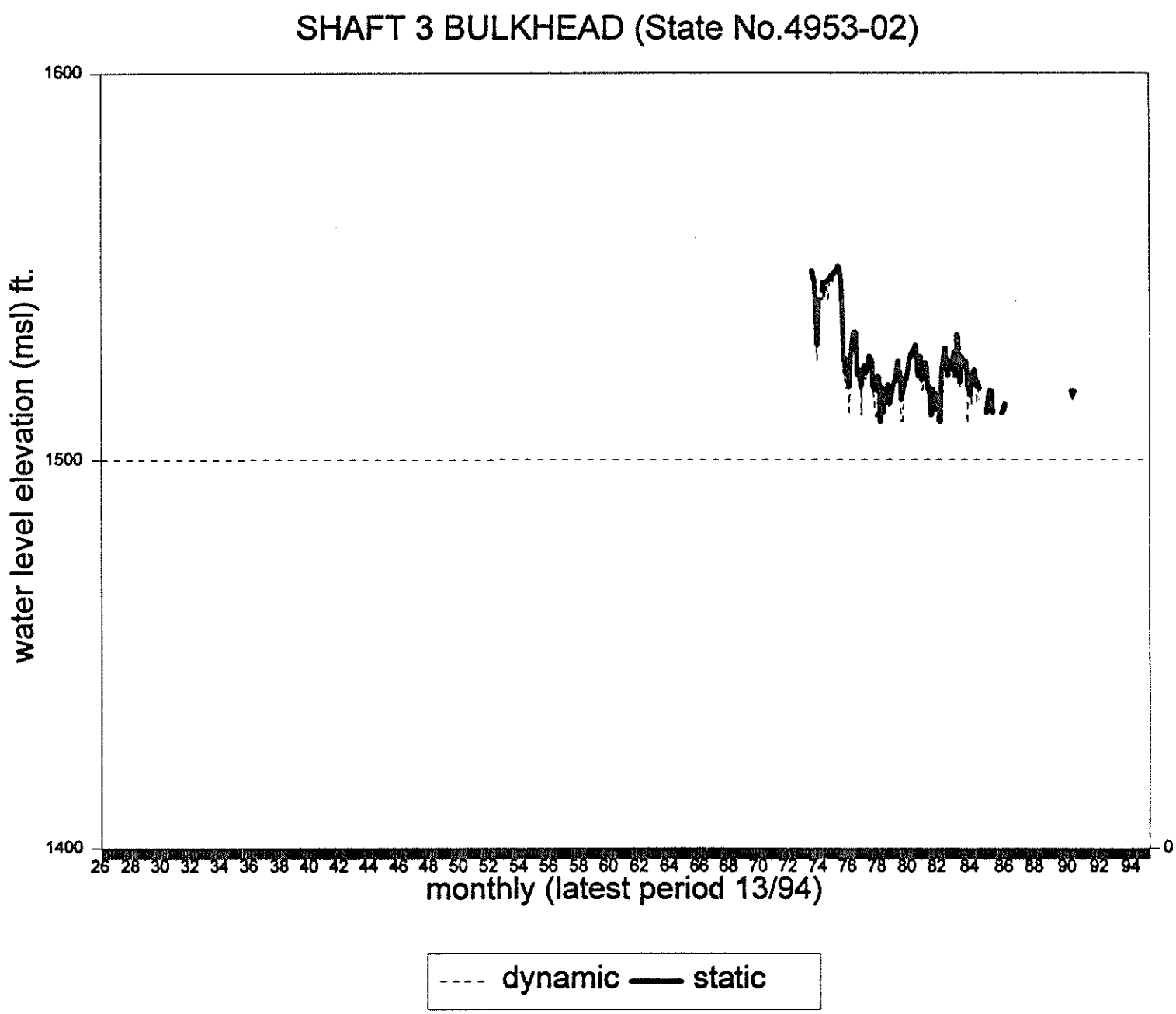

LOWER MAUNALEI TUN (State No.5053-01)
water level elevation (msl) ft.
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Constant water level elevation = 1103
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
water level

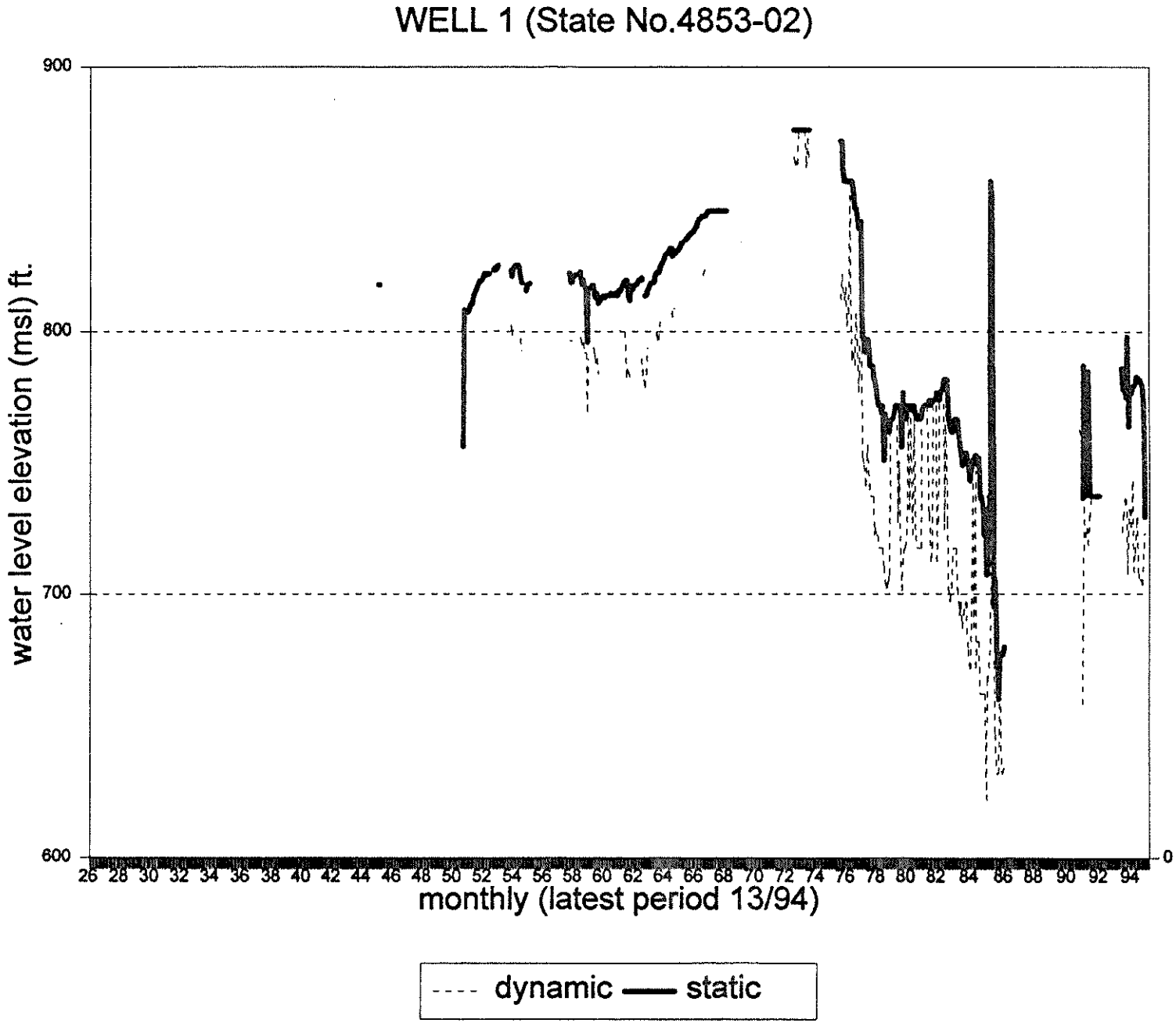

UPPER MAUNALEI TUN(State No.5053-02)
Constant water level elevation = 1505 msl
water level elevation (msl) ft.
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
water level

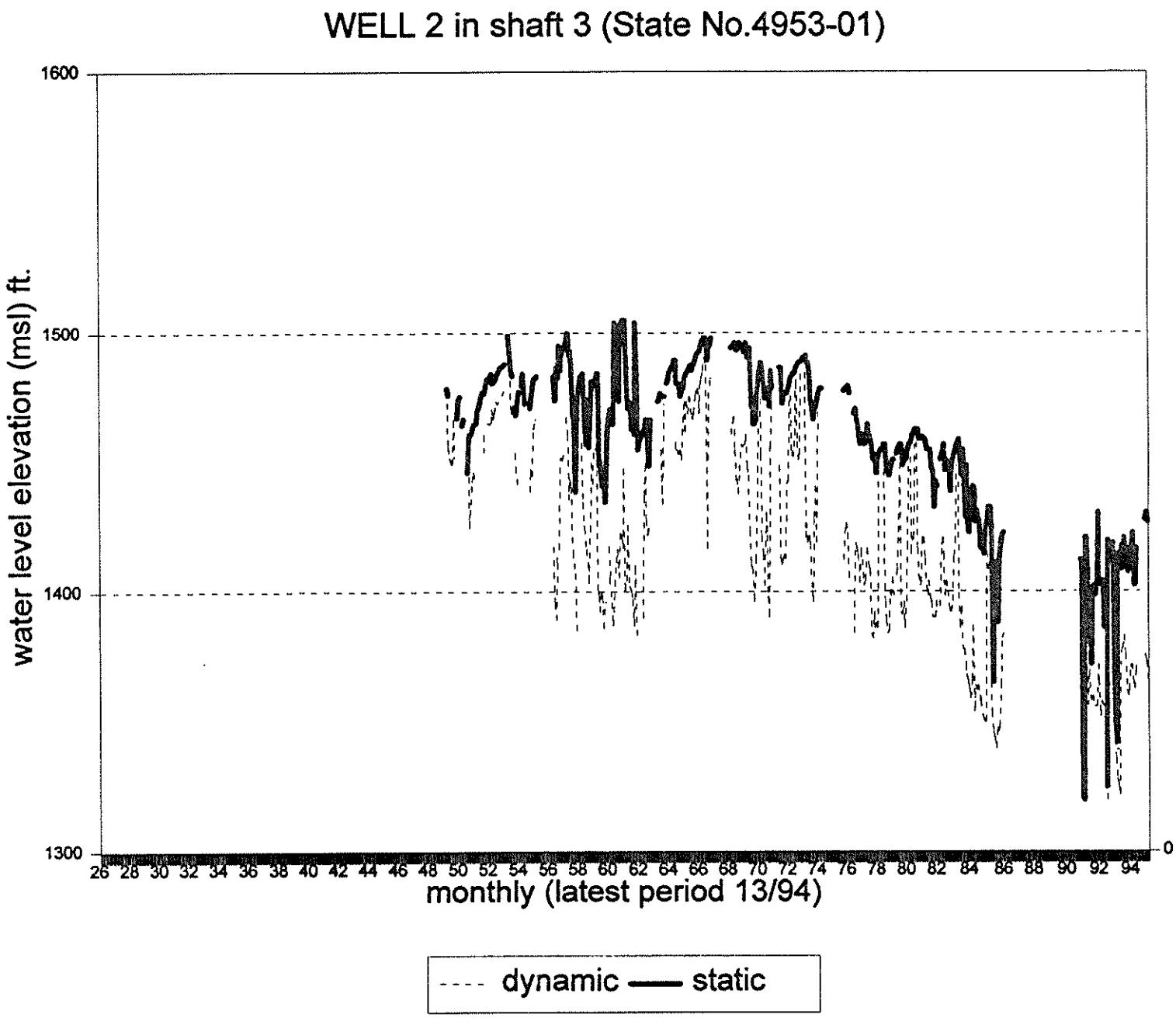
SHAFT 1 (State No.5253-01)

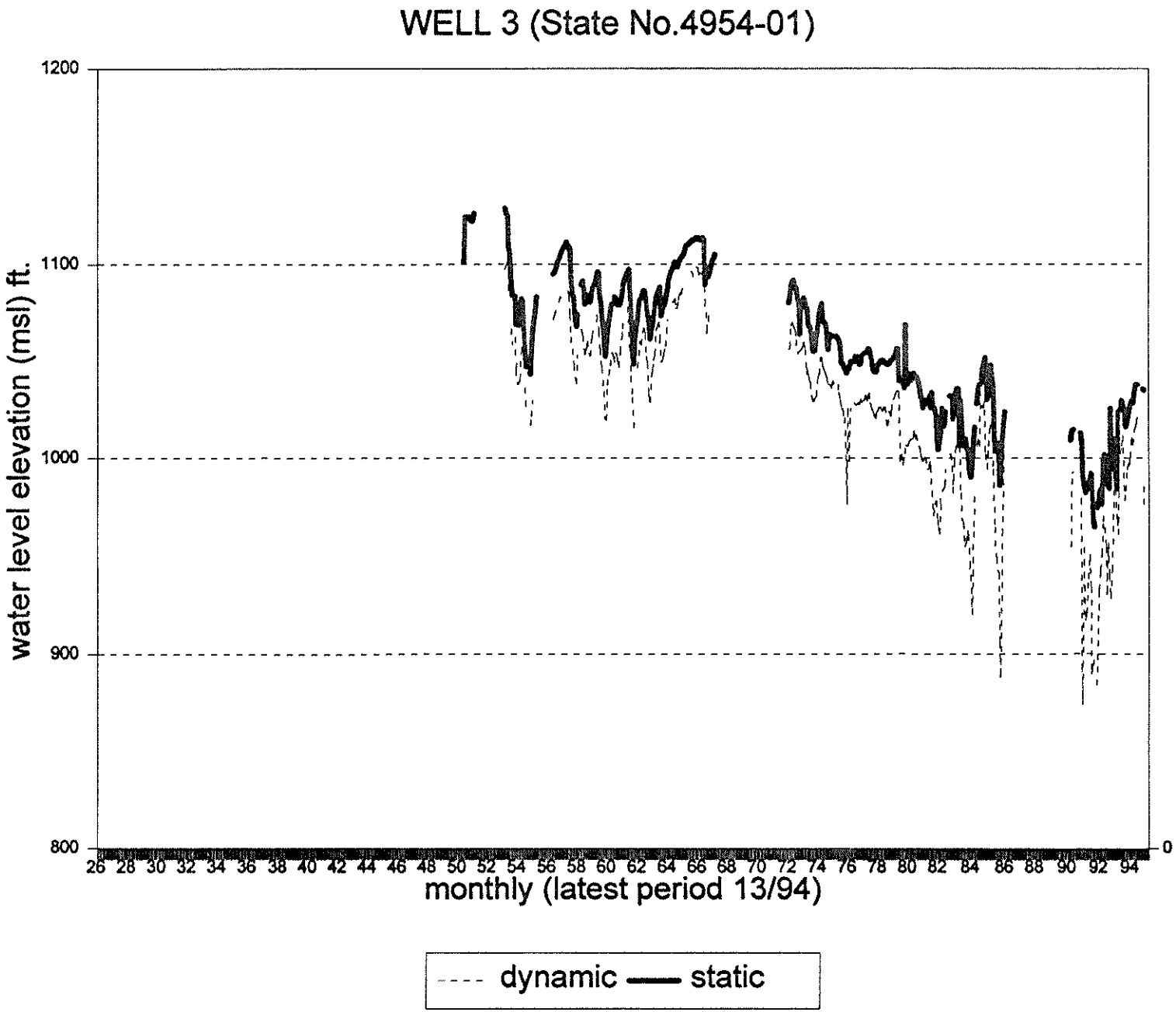


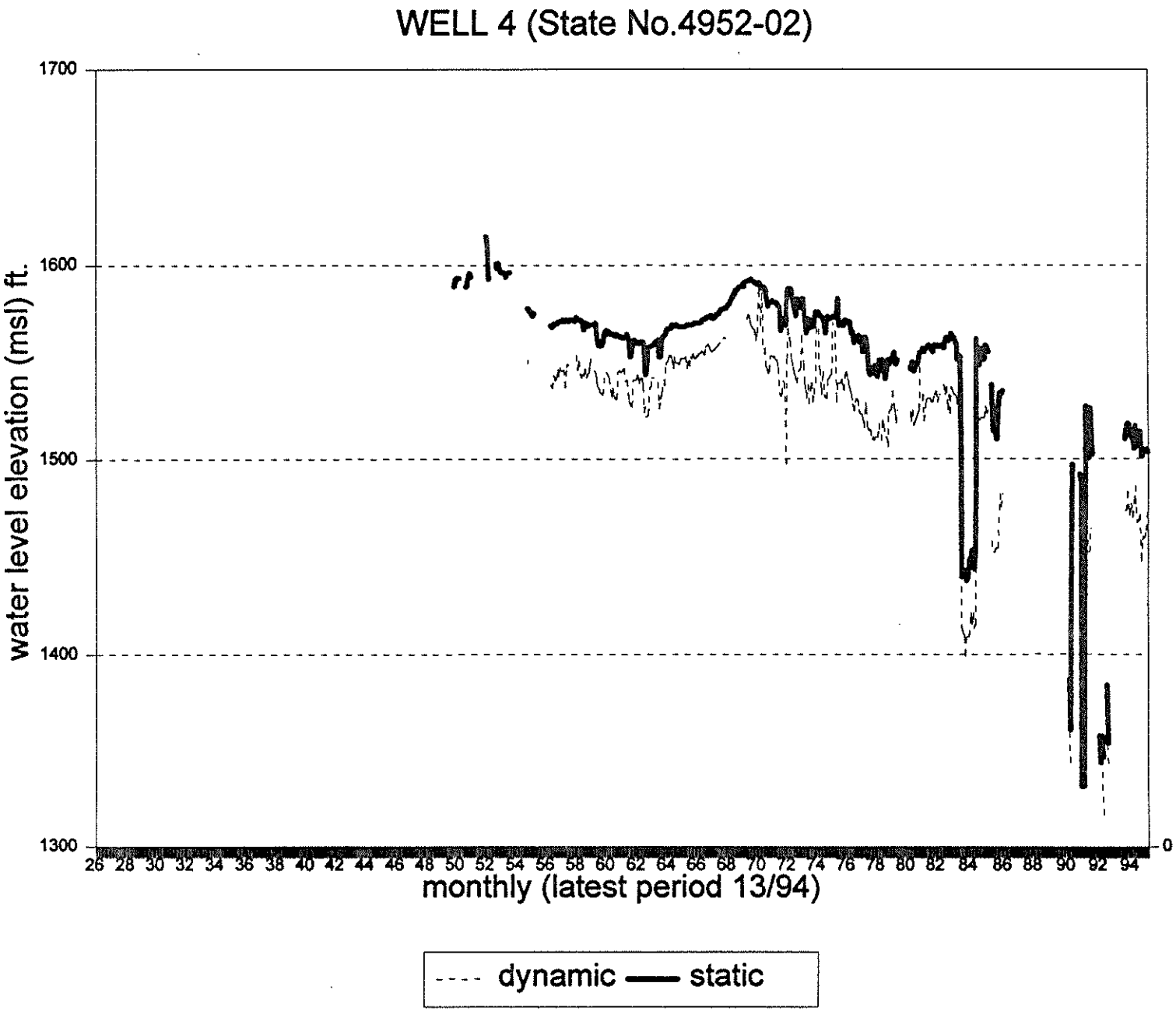

SHAFT 2 (State No.5154-01)
water level elevation (msl) ft.
800
700
600
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static

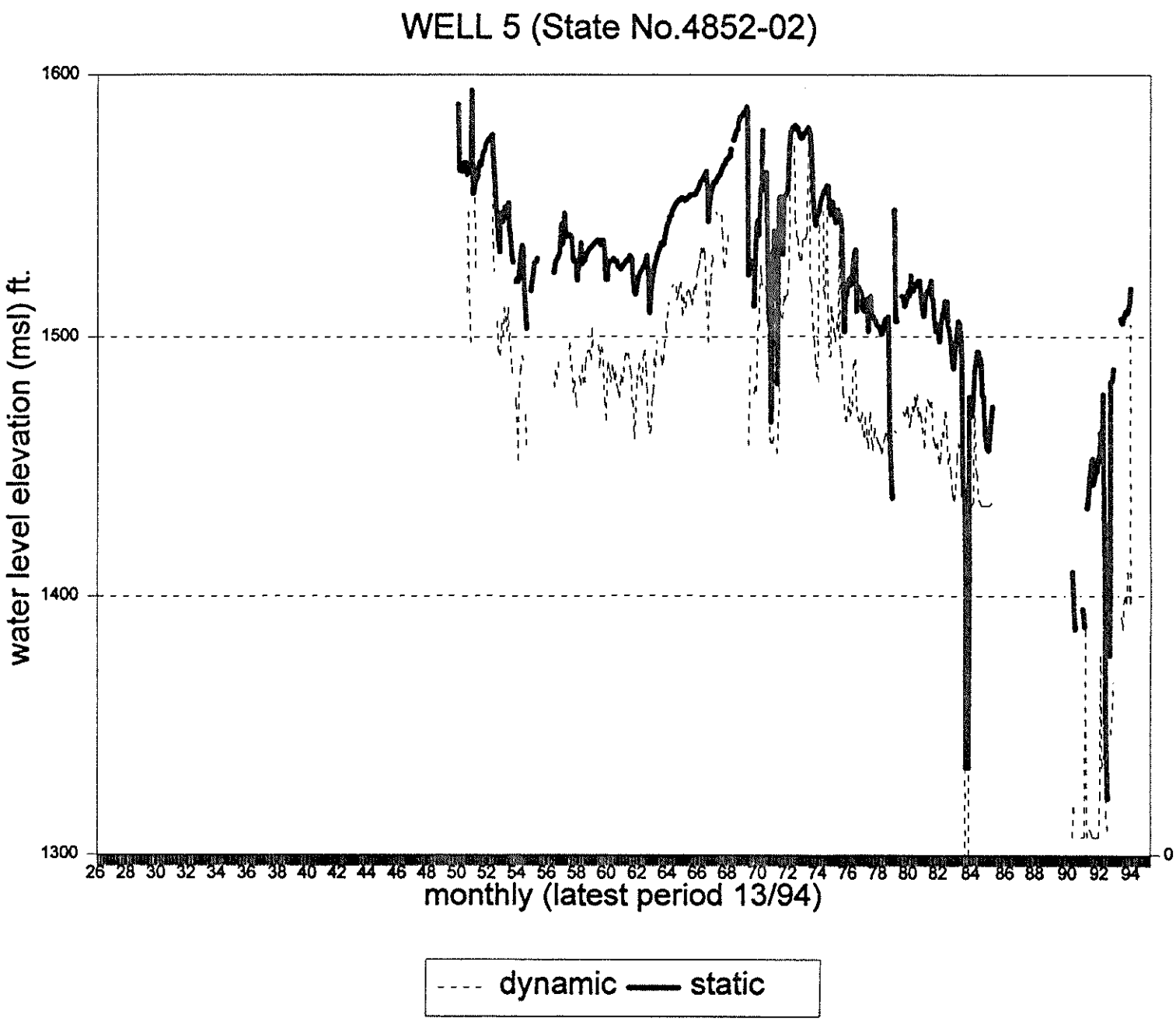

SHAFT 3 BULKHEAD (State No.4953-02)
water level elevation (msl) ft.
1600
1500
1400
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static

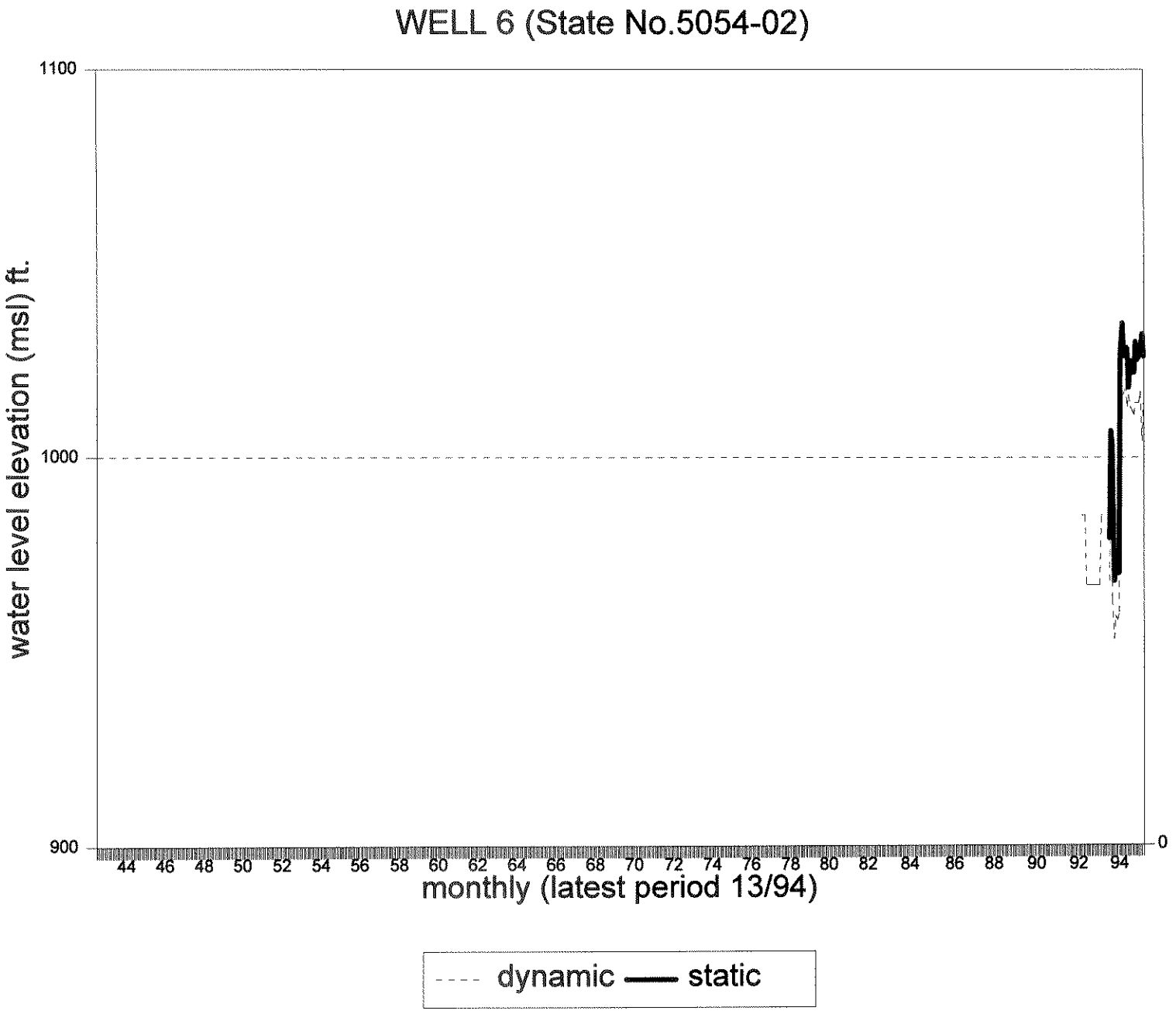

WELL 1 (State No.4853-02)
water level elevation (msl) ft.
900
800
700
600
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static

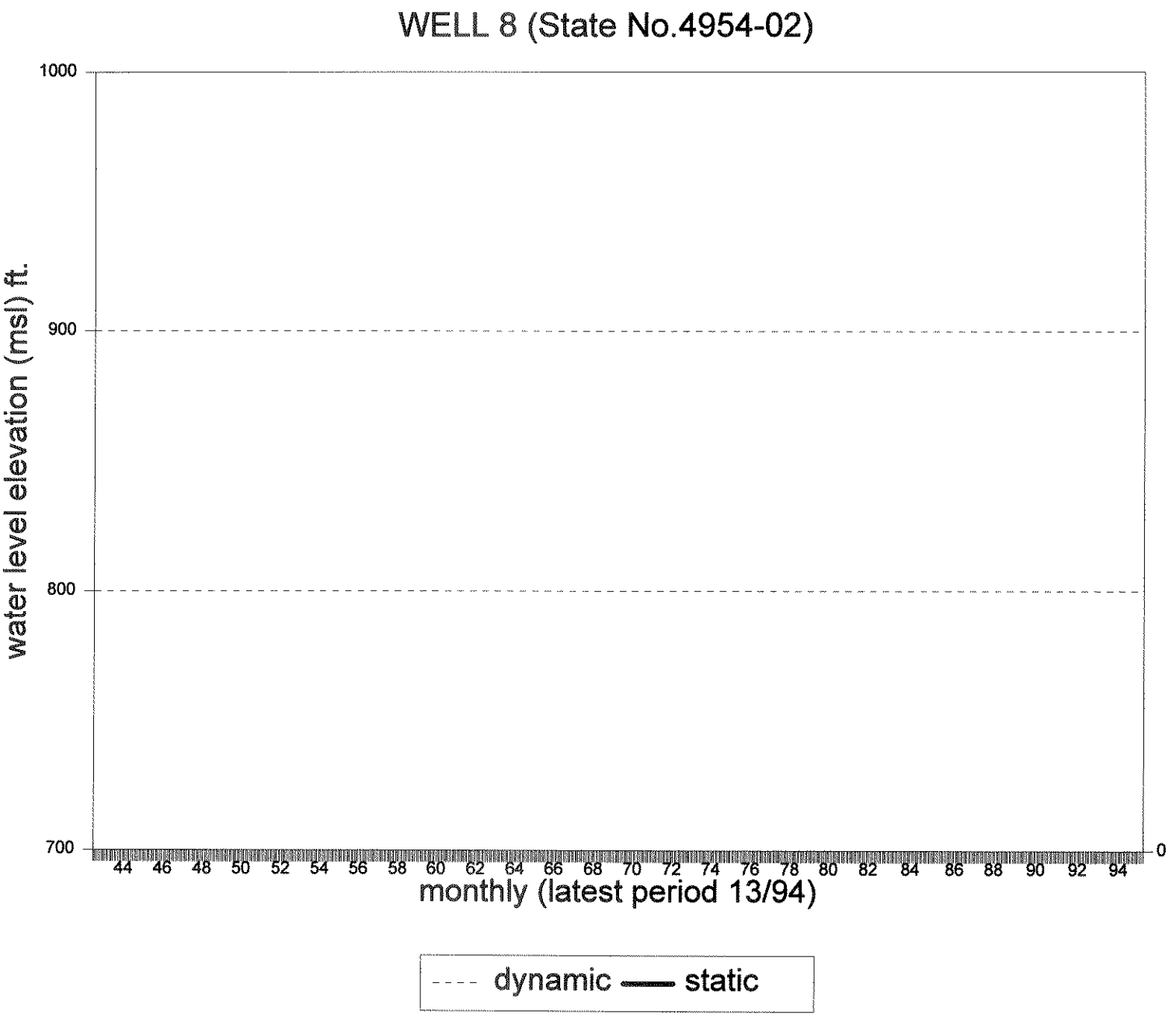

WELL 2 in shaft 3 (State No.4953-01)
water level elevation (msl) ft.
1600
1500
1400
1300
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static

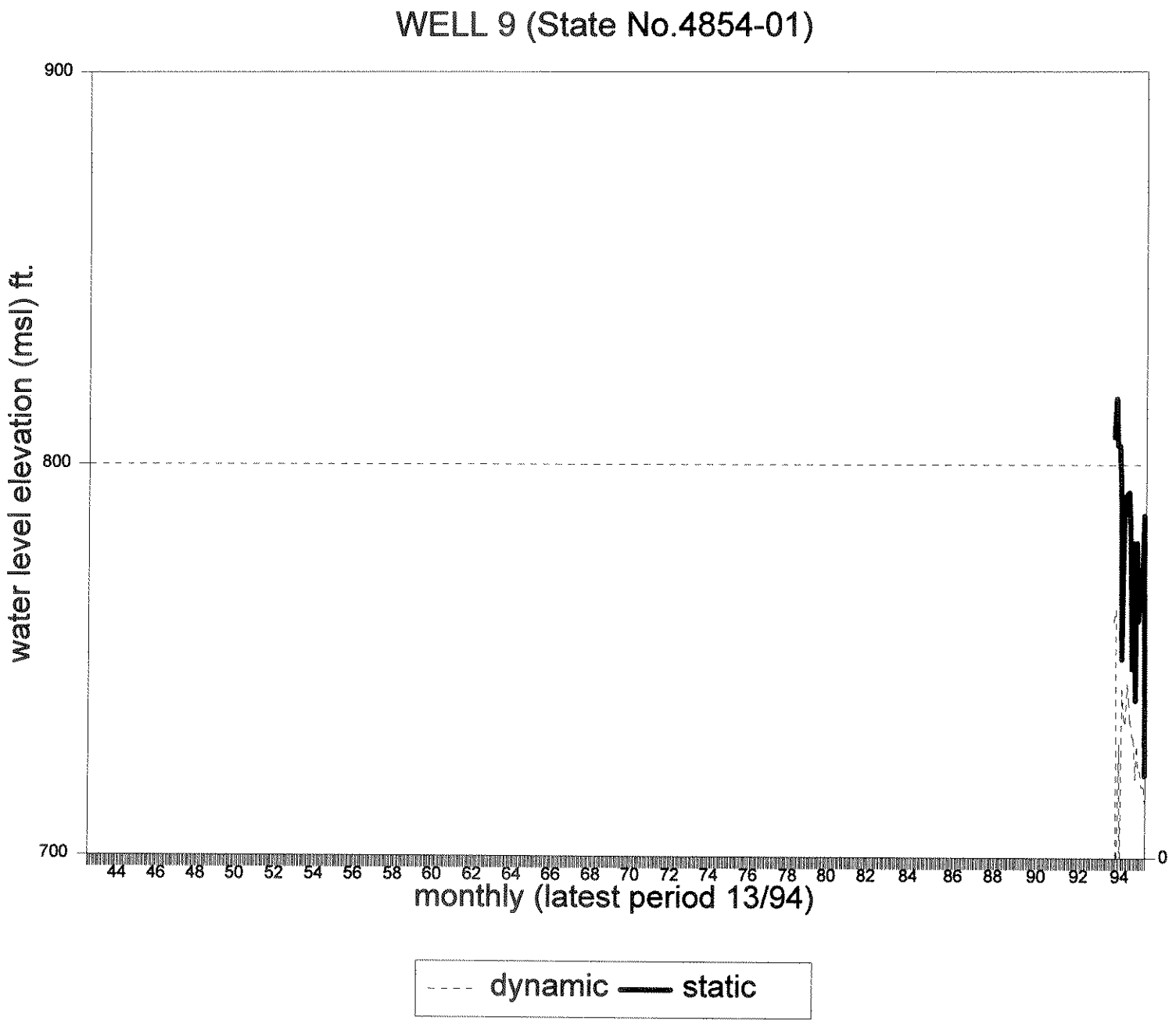

WELL 3 (State No.4954-01)
water level elevation (msl) ft.
1200
1100
1000
900
800
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static


WELL 4 (State No.4952-02)
water level elevation (msl) ft.
1700
1600
1500
1400
1300
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static


WELL 5 (State No.4852-02)
water level elevation (msl) ft.
1600
1500
1400
1300
0
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static


WELL 6 (State No.5054-02)
water level elevation (msl) ft.
1100
1000
900
0
44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static


WELL 8 (State No.4954-02)
water level elevation (msl) ft.
1000
900
800
700
0
44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static


WELL 9 (State No.4854-01)
water level elevation (msl) ft.
900
800
700
0
44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94
monthly (latest period 13/94)
dynamic
static

Existing Wells, Historical Pumpage, and Water-Levels

There are twenty-four (24) wells with information helpful to the modeling effort. A new well, Well 14 is currently under construction. The location of these wells are shown Figure 1, pg. 2. These wells and their information relevant to producing a flow-model are listed in Table 13, pg. 50, and Figures 17 through 30. Individual chloride information has been omitted to emphasize the flow-type nature of the model. Both water-levels and pumpage from these wells vary temporally according to seasonal and operational changes and are shown for each well and the cumulative pumpage in Figures 17 through 30. Magnified views of monthly water-level responses for each well can be found in Appendix H.

On an island-wide basis, Lana'i has a long record of both pumpage and water-level data. The historical record of pumpage and water-level data spans from 1926 to the present. Records from 1926 to 1939 and 1942 to 1985 were found on file at the USGS and records from 1988 to the present are found in CWRM files. Records for 1986 through 1987 were provided by LCo.

Aquifer hydraulic parameters are also listed in Table 13. The three (3) hydraulic parameters listed are hydraulic conductivity, ***K***, transmissivity, ***T***, and the storage coefficient, ***S***. These parameters, their significance, and how they are obtained were discussed earlier and in more detail. It is important to note that there are nine (9) estimates for ***K*** and ***T*** but only one (1) estimate for ***S***. This highlights the fact that *single-well* pumping tests were the conditions under which the majority of these parameters were obtained. Therefore, for reasons outlined earlier, these values were obtained under less than ideal situations. Thus, errors are present it should be understood that the values in Table 13, pg. 50, are not absolute nor necessarily accurate. However, they do provide a reasonable range to begin the flow model parameter estimation process. Where possible, reported values were checked using pump analysis software (Geraghty, 1989).

The average ***T*** value from nine (9) high-level pump tests is 7,854 ft^2/day. However, ***T*** values are not accurately known because accurate high-level aquifer thicknesses, ***b***, are unknown and vary between analyses.

The average ***K*** value from nine (9) high-level pump tests is 18.3 ft/day. Like ***T*** values, ***K*** values are very rough approximations since ***b*** is unknown Typical values for ***K*** in basalt can range from 10^{-7} to 10^5 f./day (Heath, 1982). Research by Sooros (1973) estimated the range for Pearl Harbor flank flows between 7 to 8500 ft/day. For dike complexes outside of caldera regions on southeastern Oahu, Takasaki & Mink (1982) had estimated a range for ***K*** from 1 to 500 ft/day. Therefore, the average ***K*** is for Lana'i is consistent with values for dike complexes. However, several of these pump tests, specifically wells 1, 3, and 9 are known to have encountered flow boundaries. Therefore, ***K*** values are probably higher than those estimated from past pump tests. Also, ***K*** values were estimated by consultants assuming different aquifer thicknesses. Additionally, the pump test for Shaft 1 indicates a much higher ***K*** value for the basal regions of Lana'i.

Typical values for ***S*** range from 0.1 to 0.3 for unconfined aquifers. However, only one (1) estimate for ***S*** was made by Mink (1983) based on an observation well, T-2, data. ***S*** is important for transient model simulations only. As stated earlier, ***S*** could be 41 times for a lens type situation. However, since the high-level aquifer is not known to follow the Gyhben-Herzberg relationship, unknown lag-time considerations of transition zone movement, and transmissivity would have to be modified as well, it is probable that 0.1 to 0.3 is a reasonable range.

Table 13. Existing Lana'i Wells

Well No.	Well Name	Year Initially Drilled	Initial Water-Level Elevation (ft. msl)	Initial Bottom of Well Elevation (ft. msl)	*K* (ft/day)	*T* (ft^2/day)	*S*	Historical Pumpage/ Water-Levels
4454-01	Manele	[a]na	2.5	na	na	na	na	na
4552-01	Well 12	1990	5	-25			na	na
4553-01	Well 13	1990	0	-25			na	na
4555-01	Well 10	1989	208	208			na	na
4852-01	MH Tunnel	1918	Dry	2,700	na	na	na	na
4852-02	Well 5	1950	1,570	1174	[bc]16.4	[bc]6,412	na	Figure 17
4852-03	USGS T-2	na	na	na	[bc]11.2	[bc]4,355	[b]0.1	na
4853-01	Gay Tunnel	1920	Dry	1,920	na	na	na	na
4853-02	Well 1	1945	818	-3	[de]4.8	[de]3,740	na	Figure 18
4854-01	Well 9	1990	[f]808	446	[de]3.2	[de]2,670	na	Figure 19
4952-01	Waiapaa Tun.	1924	Dry	2,220	na	na	na	na
4952-02	Well 4	1950	1,589	1,149	[bc]6.0	[bc]2,663	na	Figure 20
4953-01	Well 2	1946	1,544	903			na	Figure 21
4953-02	Shaft 3	1954	1,553	[g]1,510			na	Figure 22
4954-01	Well 3	1950	[h]1,124	651	[bce]6.1	[bce]2,902	na	Figure 23
4954-02	Well 8	1990	1,014	412	[i]16.5	[i]9,900	na	Figure 24
5053-01	Lower Tunnel	1911	1,103	1,103	na	na	na	Figure 25
5053-02	Upper Tunnel	1911	1,500	1,500	na	na	na	Figure 26
5054-01	USGS T-3	1950	[k]1,064	ground-928.6	na	na	na	na
5054-02	Well 6	1986	1,005	600	[l]88.6	[l]35,640	na	Figure 27
5055-01	Well 7	1987	650	450	[l]12	[c]2,400	na	na
5149-01	Gay Well A	1900	2	-44	na	na	na	na
5154-01	Shaft 2	1938	735	479	na	na	na	Figure 28
5253-01	Shaft 1	1936	2.4	1.4	[m]4,500	[m]450,000	na	Figure 29
TOTAL Data	24 wells	na	22	20	9	9	1	Figure 30
AVERAGE	na	na	na	na	[n]18.3	[n]7,854	0.1	Figure 30

a. not available/ not applicable
b. Mink (1983), Jacob's Method & b =i initial head to bottom of well (u=0.08 ✪ T2).
c. based on recovery data & Theis method.
d. Nance (1993), Jacob's Method & b = initial water-level above sea level.
e. Probable boundary encountered
f. Updated from K. Takasaki x/x/9x field investigation and resurveyed ground elevation information.
g. based on Stearns (1953 & 1959) length of tunnel behind bulkhead is 745.5 ft.
h. based on Stearns (1959).
i. Pump test report M&E Pacific (1991), Modified Soroos Method.
j. b= water table to bottom of well.
k. based on Stearns (1959).
l. Soroos Method (1973) modified.
m. Based on Theis equation although Theim is more appropriate no observation. wells (Takasaki & Mink, 1982); probably too high.
n. not including results from Shaft 1 since it is a basal source.

Other Notes to Table 13

K = estimated hydraulic conductivity from assuming aquifer thicknesses and *T* results.
T = estimated transmissivity from pump tests.
S = storage coefficient.
msl = mean sea level

Evapotranspiration (ET, ET_p, & ET_a)

Evapotranspiration, ET, is the combination of evaporation and plant transpiration processes which return water to the atmosphere. It is important to understand that these two processes are very difficult to segregate (Todd, 1980). in this study, potential ET, or ET_p, is very is assumed to be the water which will evaporate from a properly operated Class A type pan. This, in turn, identifies maximum ET_p. It is also important to understand that many factors affect pan evaporation, such as temperature, humidity, solar radiation, wind, and even the height of the pan above the ground, but all these data are not available for Lana'i. It is important to note that the error associated estimating evaporation from a Class A pan itself can be as much as $\pm$ 10% (Ekern, & others, 1985, Shuttleworth, 1993). Aside from pan evaporation methods, hydrologists commonly use the Penman Equation (Penman, 1948) to estimate the potential for evaporation from the surface of water, exposed openly to the air, through aerodynamic and energy budget considerations. Chang (1968) noted that the Penman Equation only gives approximations of open water evaporation and is also different than ET_p where vegetation type and height is important. The same factors which affect ET_p also affect actual ET, or ET_a, but the influence of vegetative type and density, root-zone depth, soil-moisture storage (SMS), and density of capillary tubes in the soil are additional considerations. ET_a can be estimated as percentages of ET_p. Normally, increases in all factors result in increased ET_a although it has been shown that some vegetative cover can actually reduce ET_a such that it is significantly less than ET_p. Pineapple has been shown to reduce local ET_a by about 20% below ET_p (Ekern, 1960). However, ET_a can also exceed measured pan evaporation, ET_p. In optimum sugarcane cultivation conditions, sugarcane water requirements may go as high as factors of 1.1 to 1.2 times pan evaporation (Chang, 1961; Jones, 1980).

There is little direct pan evaporation data to estimate ET_p on Lana'i. State Report R74 (Ekern & Chang, 1985) identifies only one pan evaporation station, Station No. 687.00 at Lana'i City, having a limited duration of data collection (1957-1958) with an average rate of 25.63 in./yr. This measured amount is quite low, especially knowing that over the open ocean the pan evaporation rate is approximately 80 in./yr. The lower temperature associated with the higher elevation of Lanai City (>1500 ft. msl) is probably a major reason for this lower measurement. According to LCo. there is no additional data they have on file. Stearns (1940) stated that it is obvious that transpiration requirements are not met on Lana'i except for the seven (7) square miles around Lanaihale where the soil is muddy or damp for most of the year. Ostensibly, earlier overall ET estimates were based on professional opinion.

Although pan evaporation data is limited, three (3) methods were considered to estimate ET_p patterns. In both methods, it is assumed that ET_p is equal to pan evaporation. First, one could use Ekern & Chang's (1985) state-wide pan evaporation study conclusion that in areas beneath tradewind orographic clouds evaporation ranges from 30 to 40% less than the oceanic rate while in dry leeward areas evaporation was 30 to 40% more than the oceanic rate. These rates could then be applied uniformly for areas above and below the 2000 ft. elevation, respectively. Secondly, monthly ET_p/RF rations could be estimated and used in spatially consistent manner like the first method. Thirdly, monthly ET_p ratios can be computed from the monthly percentages of the total annual evaporation actually measured at Lana'i City.

Of the three methods considered, the third approach of estimating monthly ET_p percentages of total annual evaporation was considered the best method. Although a good rough estimate for ET_p, the windward/leeward percentage of oceanic rate was not chosen because oceanic rates around Lana'i have not been measured nor is this approach discretized enough both spatially and temporally. Because ET_p is a function of aerodynamic and energy processes, not rainfall, the method of ET_p/RF is not a valid ratio estimation. Instead, the annual total pan evaporation can be broken down into its monthly values to incorporate the monthly variations of ET_p, which can then be used with other monthly estimated parameter values with equation eq.(4), pg. 18. Although the period of data is limited, the monthly pan data provides the most direct estimate of monthly ET_p. This approach is summarized in Table 8.

Table 8. Estimate of Monthly ET_p/ET_{annual} Ratios based on Pan Data

(Source: Ekern, 1964.)

Month[1]	ET_p Average Evaporation[a] (in.)	$\frac{ET_p}{ET_{annual}}$ Ratio[b]
January	1.73	0.07
February	2.35	0.09
March	2.45	0.10
April	2.58	0.10
May	2.18	0.09
June	2.07	0.08
July	2.64	0.10
August	2.35	0.09
September	2.11	0.08
October	2.67	0.10
November	1.00	0.04
December	1.50	0.06
ET_{annual}[c]	25.63	1.00

a. unadjusted monthly data from Station No. 687.00, Ekern & Chang,1985), (1/57 to 12/57 period)

b. ET_p/ET_{annual} = Potential evapotranspiration to total annual evapotranspiration ratio.

c. For areas >2000 ft. elevation based on unadjusted data from Class A pan

a. Aquifer is infinite.
b. Aquifer is homogenous and isotropic.
c. Position and nature of aquifer boundaries.
d. Occurrence and nature of confining beds.
e. Thickness of aquifer is known.
f. Fluid is homogeneous.
g. Flow to well is uniform and horizontal only.
h. Ideally, wells are fully, not partially, penetrating into the aquifer.
i. Length of aquifer pump test period is adequate.
j. Pumping rate is constant.
k. Well losses vs. aquifer losses are known.
l. Nominal vs. effective radius of well are known.

As stated earlier, one major assumption for this model is that the regional scale the aquifer is homogeneous and isoptropic. This assumption is almost certainly invalid at the local scale associated with aquifer pumping tests. With these caveats in mind it is quite evident that the effective ***K***, ***T***, and ***S*** values can only be approximated and will be appropriate only for the grid and cell size used in this study.

For Lana'i and in the well information portion of this report, Table 13, pg. 50, lists the results of field pumping test data which estimate the ***K***, ***T***, and ***S*** parameters. The average ***K*** of nine (9) tests is 18.3 ft/day, the average ***T*** of nine (9) pump tests is 7,854 ft^2/day, and ***S***, based on one test, is 0.1. These parameters are discussed in more detail in the well information section of this report.

Water-budget Analysis

The goal of the water-budget analysis is to estimate how much water eventually reaches the ground-water table and becomes part of the ground-water system. This estimate is commonly known as ground-water recharge. What is not common is a universally accepted method for making this estimation (Anderson, & others, 1992). The general water-budget or mass-balance equation used to estimate recharge for this study was based on previous studies (Thornthwait, 1955, Shade, 1995) through Equation eq.(4) as follows:

$$RF + FD + IR - DRO - \Delta SMS - ET = R \qquad \text{eq.(4)}$$

where:

RF = Rainfall precipitation
FD = Fog-drip precipitation
IR = Irrigation return = 0 for this study.
DRO = Direct runoff
ΔSMS = Change in soil-moisture storage
ET = Evapotranspiration
R = Recharge

In reality, Equation eq.(4) is the same equation used in all other previous studies for estimating Lanai's ground-water recharge, R. In earlier studies for Lana'i the terms for fog-drip, FD, irrigation, IR, and soil-moisture storage, ΔSMS, terms were not considered; in other words these parameters were set to zero (0). Later studies began to acknowledge the impact of FD on Lanai's ground-water R. This study considers the effects of both FD and ΔSMS but continues to ignore IR effects because most of the island is unirrigated and pineapple receives little, if any, irrigation.

Differences between estimations of R were thus based on hydrologists' differences in the values assigned individual parameters in Equation eq.(4). However, all the previous parameter estimations shared a significant commonality; parameter estimations were based on total annual averages. This study's parameter estimations are based on month-to-month variations to estimate annual averages.

The contemporary methodology, or Equation eq.(4), considers the difference between potential evapotranspiration, ET_p, vs. actual evapotranspiration, ET_a, in conjunction with ΔSMS, considerations whereas previous water-budget analyses did not. Basically, this considers the available water for evaporation. The transient time periods selected could be monthly or even daily depending on the available data. Ultimately, using monthly averages for the given parameters while considering and including ΔSMS in the budget equation will result in a lower total annual value of ET_a. This is because at drier times of the year there is not enough soil-moisture available to achieve the full ET_p which may otherwise be estimated at an evaporation pan station. This is especially true during periods of drought when soil-moisture is extremely low for short periods of time (State of Hawaii, 1991). Therefore, the contemporary approach yields greater R values than those derived solely by annual averages.