Exhibit SNC 000048

J. Strom Thurmond Dam and Lake Water Control Plan and Guide Curves

VII. WATER CONTROL PLAN

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J. STROM THURMOND DAM AND LAKE
GEORGIA AND SOUTH CAROLINA

VII - ***WATER CONTROL PLAN***

T7-01. *General Objectives* .

The J. Strom Thurmond Project was the first of three multiple-purpose projects that the Federal Government built in the Savannah River Basin. This project, originally named the Clark Hill Project, was completed and began operation in 1952. The authorized purposes of the J. Strom Thurmond project are water supply, hydroelectric power, flood control, fish and wildlife, water quality and recreation. This water control management plan has been developed for the J. Strom Thurmond Dam and Lake multi-purpose project to conform with the objectives and specific provisions of the authorizing legislation for the Hartwell, Richard B. Russell and Thurmond projects and applicable Corps of Engineers directives.

T7-02 . *Overall Plan for Water Control* .

Water control management decisions at the J. Strom Thurmond Project take into account hydrologic and climatological factors, conditions at the upstream projects, needs of the downstream water users, potential threats of flood or drought, present and projected lake levels, and the constraints of recreation, fish management, water supply, water quality, and hydroelectric power production. Evaluation of these factors requires well-qualified, technically trained personnel with special experience in the field of modern hydrology, hydraulic engineering, and water control management. The Savannah District maintains this expertise in the Hydraulics Section of the Hydrology and Hydraulics Branch (the Water Control Center), with the assistance of fish and wildlife and recreation experts. Close coordination with the plant operators, whose experience and on-site location makes them a vital part of the water control team, is essential. The Savannah District reports water control conditions and activities to the South Atlantic Division (SAD) office in Atlanta.

The J. Strom Thurmond Project has 18 feet of conservation storage, from elevation 312 to 330 feet NGVD, which accounts for 1,045,000 acre feet of storage. The flood control storage available between 330 and 335 is 390,000 acre feet. The project has a seasonal drawdown of the flood control pool. The guide curve is shown in Plate T7.9. The area-capacity curve for the project is found at Plate T7.3 and the corresponding storage table is shown in Table T7-1.

a. *System management* . Decisions concerning water control for the Thurmond Project are part of a coordinated multi-reservoir system regulation for the Savannah River Basin, as well as part of the operation of the larger power network for the southeastern United States (coordinated through SAD).

b. *Compatibility Among Purposes* .

Fish and Wildlife or **Water Quality** and turbine or spillway releases for **Flood Control** : During flood control operations, passing inflow through the project may have negative impacts on water quality or fisheries, both within the lake and downstream.

Fish and Wildlife or **Water Quality** and turbine releases for **Hydropower** : During periods when the pool must be maintained at a constant level for such purposes as fish spawning, releases through the turbines for energy production may be curtailed or eliminated altogether, depending on inflows.

Recreation and **Hydropower** : Particularly during drought periods, potential exists for such a conflict. Continued power generation to meet contractual requirements for electrical power may cause pool elevations to fall to levels which adversely affect recreational uses of the lake. Boat ramps may no longer be functional, underwater hazards may become a danger to boaters, and formerly scenic areas may become unattractive.

Water Supply and **Hydropower** : Particularly during drought periods, potential exists for such a conflict. Continued power generation to meet contractual requirements may cause pool levels to fall below the elevations of the intake structures of the water users for Thurmond Lake.

Recreation and **Flood Control** : Due to the risk of flood damages and injuries, any necessary flood control regulation is given highest priority.

c. *Normal Regulation Activities* .

The Water Control Center is responsible for the long term planning and supervision of the operation of rainfall and river stage reporting. Weekly activities are as follows:

(1) *Weekly Water Volume Analysis* . The Water Control Manager compiles necessary basic data on precipitation, river stages, reservoir elevations, and general streamflow conditions. Using this data, the manager prepares inflow, discharge, storage and pool elevation projections for the following week, which is presented by noon each Wednesday. Water generation availability analyses and forecasts for the three reservoir system are also presented at this time. Projections are based on lake levels, lake level guide curves, power contract commitments, antecedent and expected rainfall, and rainfall-runoff relationships for the upper Savannah River Basin. Additional considerations which affect discharges are powerplant maintenance activities, proposed operational changes which would affect power generation, and water level management activities related to fisheries or recreation. Input concerning these matters is normally received on Wednesdays from the Planning Division and the Technical Support Branch of Operations Division.

(2) *Weekly Report to the South Atlantic Division (SAD)* . The weekly declaration of releases, the "Water Volume Analysis",is posted on the Water Management web site,http://water.sas.usace.army.mil, and is transmitted to the Water Management Branch of South Atlantic Division by the Water Control Center every Wednesday afternoon. The water control managers then consult with the Southeastern Power Administration (SEPA), the marketing agency for Federally generated power in the southeastern states.

(3) *Weekly Meeting* . Each Thursday morning the Water Control Manager conducts a meeting with Operations and Planning Division personnel to review storage and pool elevation projections and power generation availability analyses. The Water Control Manager transmits water control data (pool elevations, inflows, outflows, precipitation, hydrographs at downstream control points, and other hydrologic data) to SAD.

(4) *Final Generation Schedule* . Following confirmation by SEPA, SAD advises the Water Control Center each Friday of the amount of energy to be taken from each of the three projects. SEPA's customers (the power companies) furnish hourly schedules directly to the Project Operator with copies furnished to the Water Control Center.

T7-03 . *Standing Instructions to the Project Operator* .

A summary of reservoir regulation procedures for the project operator during both normal and emergency situations is found in Exhibit T7-A. During communication outages, unforeseen or emergency events, as well as periods of normal operation, standing instructions are essential to ensure efficient and safe operation of the project at all times. The operation instructions clearly outline the physical constraints, such as spillway/outlet work restrictions, based on design limitations.

The Hydraulics Section, Hydrology and Hydraulics Branch, Engineering Division, Savannah District, is responsible for water control management of the Savannah River Basin which includes the regulation of the J. Strom Thurmond Dam and Lake. Operations Division is responsible for the operation and maintenance of these projects. Assigning responsibility for water control management to the Hydraulics Section does not diminish the necessity for or the

desirability of appropriate and adequate inter-staff coordination. Hydraulics Section is responsible for insuring that such coordination has been effected and subsequent actions are taken. The project operators at each of the three dams are responsible to the water control manager for all water control actions.

Transmission of instructions from the water control manager through several individuals or organizational units can be a source of delay and misunderstandings. Clear lines of communication and authority must be maintained. Occasionally, water control management decisions necessitate that the water control manager (in Engineering Division) contact the project operator directly so that satisfactory instructions can be given or hydrologic data can be obtained. Particularly during time of emergencies, there must be no delay in transmission of instructions or hydrologic data between the project operator and the water control manager. In these instances, the project operator will act on instructions received directly from the water control manager on all matters regarding the regulation of water. Advisory notification is furnished to Operations Division as soon as possible.

T7-04 . *Flood Control* .

a. *General* . The objective of flood control regulation at the J. Strom Thurmond Project is to reduce flood damages to the lower Savannah River Basin the extent possible. Normal conditions exist when there is no flood, drought or other emergency and none is anticipated. Normal pool varies seasonally from elevation 326 to 330 feet NGVD. During the period between May and October 15th, the J. Strom Thurmond Project has 5 feet of flood control storage, from elevation 330 feet NGVD to 335 feet NGVD. The flood control storage available between 330 and 335 is 390,000 acre feet. Between October 15th and December 15th the pool is drawn down to a seasonal normal pool of 326 ft NGVD, to allow for the statistically higher winter and spring rainfall. This increases the available storage by 280,000 acre feet, to a total available storage of 670,000 acre feet. (see Table T7-1) From January to May, the normal pool is increased back to elevation 330. The guide curve is shown in Plate T7.9

b. *Flood Regulation* . Reservoir operation during flood conditions must be adjusted to account for variation in reservoir stage and quantity of rainfall runoff. Plate T7.4 contains detailed instructions for operations to fit the individual flood occurrence. All instructions pertaining to reservoir regulation for flood control are to come from the Savannah District. See the Table 5-3 for a listing of Savannah District flood control personnel and their telephone numbers.

The Water Control Manager performs flood routings and makes lake elevation and river stage forecasts, and coordinates and schedules lake releases during flood periods. Flood forecasting is accomplished using the Hydrologic Engineering Center (HEC) computer software HEC-1F, a rainfall model which uses real-time precipitation data to estimate inflows at the projects. HEC-5, an HEC model which simulates and analyzes the operation of

reservoir systems, is a highly complex multi-purpose, multi-reservoir, multiple flood reservoir system simulation tool. The model is capable of evaluating a reservoir system to determine the best operation for water quantity and quality, evaluating operational concerns such as flood control, hydropower and water supply. Mod-5 is an interactive version of HEC-5, and will enable the Water Control Manager to model various release scenarios to best manage the projects

During floods, the Water Control Manager forwards reports as necessary to SAD containing data on predicted peak stages and percentage of flood control storage utilized. The Water Control Manager informs responsible District personnel on critical weather and streamflow conditions affecting the public and District activities, and coordinates with the public affairs office to issue flood reports on flood emergencies.

When the possibility of flooding conditions at or downstream of the reservoirs exists, the Savannah District Operations Division Readiness Branch (OP-E) is contacted. OP-E coordinates implementation of evacuation plans with local government agencies prior to any flood releases, notifies the City of Augusta of the possible need for stoplogs to be installed in the levee, and dispatches flood survey teams to affected areas and notifies local officials that District facilities and personnel are available upon request to assist in emergency conditions. The Water Control Manager furnishes a forecast of pool elevations and releases to be made to meet downstream flood control requirements to the Water Management Branch, SAD. At least one of the following SAD personnel will be contacted during a flood emergency:

Mr. Chris Smith	**Office**	**(404)331-6705**
Mr. Gary Mauldin	**Office**	**(404)331-5232**

After reviewing these directives, the Hydraulics Section advises SEPA of releases to be made, and then advises the Water Control Management Branch, SAD of arrangements made with SEPA. The Water Control Manager contacts the Project Operator, and informs him of the required releases to be made as well as the allowable variations from those values. An advisory notification is then sent to Operations Division. The Water Control Manager also notifies Operations Division and SAD of the arrangements made at the first opportunity during normal working hours. The J. Strom Thurmond Flood Control Release Schedule is found in Plate T7.4.

c. *Gate Operation* . When J. Strom Thurmond Lake exceeds its flood control storage, use of the tainter gates according to the Spillway Gate Regulation Schedule (Plate T7.5) is required. All discharges other than that through the turbines should be made through the spillway gates. When all spillway gates are to be opened, discharges should be made uniformly across the spillway, as nearly as practicable, **by opening gates so that no gate opening is more than one foot larger or smaller than any other gate opening** . Gates should be opened beginning near the center of the spillway (#12) and proceeding outward. When closing the gates, the order is reversed, with #1 and #23 closed first, and proceeding towards the center of the spillway. As during raising, the gates should be closed so that no gate opening is more than one foot larger or smaller than any other gate opening. The spillway gates are numbered 1 through 23 beginning with the gate nearest the powerhouse.

d. *Emergency Regulation* . Occasionally, a need may arise to temporarily modify the water releases from a project. Examples of these needs are for search and rescue operations, to provide a specified downstream flow for a particular event, or to control a downstream pollutant.

In the execution of the water control plan, appropriate attention is given to project safety to insure that the project is operated for the safety of its users and the general public. Care is exercised in the scheduling of reservoir releases to assure that controlled releases minimize project impacts and do not jeopardize the safety of persons engaged in activities downstream of the dam. These provisions require alerting all affected interests to possible hazards.

Should a person fall into the tailrace or intake section of the project, come into contact with an energized conductor within or feeding from the project, or other wise place himself in imminent danger, the powerplant operator or nearest responsible employee takes emergency actions in accordance with established procedures.

T7-05 . *Recreation* .

The development of recreational facilities at J. Strom Thurmond Lake was based on Master Plan for Public Use and Administrative Facilities, which was updated in 1966. Recreation is an authorized purpose under the Water Resources Development Act of 1986 (PL 99-662, 100 Stat 4082, November 17, 1986).

Thurmond lake has various recreational facilities, including boat launching facilities, picnic areas, camping sites, scenic overlooks, and swimming areas. The lake and lakeshore area are managed by Operation Division's Project Office. Thurmond lake is among one of the 10 most-visited Corps of Engineers lakes in the United States

Approximately two thirds of the 71,100 acre lake is in Georgia, with the remainder in South Carolina. The irregular wooded shoreline, 1,100 miles in length, is considered a major scenic attraction. Recreational facilities include Picnic areas, boat launching ramps, family camping units, swimming areas, scenic overlooks, and various other public and private facilities.

Lake Levels are normally maintained at approximately elevation 330 from May to mid October. J. Strom Thurmond's seasonal draw down is four feet, and occurs after peak visitation periods, and causes minimal impacts to recreation activities in and around the lake. During periods of drought low lake levels may make certain boat ramps unusable, diminish the aesthetic quality of the scenery, and make some public or private facilities unavailable or undesirable.

T7-06 . *Water Quality* .

The Clean Water Act established a national objective to restore and maintain the chemical, physical and biological integrity of the Nation's waters. The thrust of this objective is to protect all existing and future uses, including assimilative capacity, aquatic life and other water quality aspects, as well as related uses, such as municipal and industrial water supply, recreation and hydropower. Our national policy is that the Federal Government (in design, construction, management, operation and maintenance of facilities) provides leadership in the nationwide effort to protect and enhance the quality of air, water and land resources and complies with all Federal, state, interstate and local requirements in the same manner and extent as non-Federal entities. Accordingly, the following general water quality management objectives apply to all South Atlantic Division lake projects:

a. Insure that water quality, as affected by the project and its operation, is suitable for project purposes, existing water uses, and public health and safety.

b. Define baseline water quality conditions for each project. This effort consists of a pre-project water quality evaluation, and a description of the post-

construction water quality characteristics developed at the earliest time that data collection and evaluation are practical.

c. Establish and maintain a water quality monitoring and data evaluation program adequate to achieve water quality management objectives and demonstrate project performance.

d. Assure that, to the extent practicable, water quality conditions associated with the project are in full compliance with applicable water quality standards.

Like all deep lakes in the South, Thurmond Lake stratifies during the summer months. A thermocline (temperature/density gradient in a layer called the metalimnion) is established during the summer months as the top waters (epilimnion) warm quicker than those at the bottom (hypolimnion). The thermocline essentially blocks circulation between the layers (which is normally provided by wind induced currents) from providing oxygen from the atmosphere and top waters to the bottom waters. Continued deposition of oxygen-demanding substances deplete the dissolved oxygen within the bottom waters, particularly at the mud/water interface. During hydropower generation in the summer, the waters discharged through the Thurmond Dam are drawn from the hypolimnion. As the summer progresses, the quality of these waters (dissolved oxygen content) degrades until "turnover," that is, the recirculation of the waters in the fall when the surface water has cooled to the temperature of the bottom waters, eliminating the temperature/density gradient.

Minimum releases of 5,400 cfs from J. Strom Thurmond Dam are the basis for Georgia NPDES Permits. South Carolina NPDES permits are based on a minimum release of 4,500 cfs. When discharges from Thurmond are below these rates, violations of permit requirements may be expected.

T7-07 . *Fish and Wildlife* .

The Savannah District conducts the following Water Control Management for Fish Management Purposes:

a. *Fish Spawning* . Water control management for fish management purposes is conducted in accordance with SAD Regulation 1130-2-16 (Exhibit B). At the earliest possible date, Operations Division notifies the Water Control Manager of the beginning and ending of the large-mouth bass spawning period. During the spawning period, the Water Control Manager schedules releases (to the maximum extent possible without jeopardizing other project purposes) so that the downward fluctuation or lowering of the lake level will not exceed 6 inches from the maximum elevation reached during the spawning period. Should it appear that maintaining lake level fluctuations within the six inch limit will not be possible, the SAD Water Control Management Branch and the Project Manager are notified by the Water Control Manager as far in advance as possible.

b. *Fish Entrainment* . The Savannah District restricts discharges at the Thurmond Project when there is a threat of killing significant numbers of fish. Fish kills at the upstream Hartwell Project and at the Thurmond Project have involved the Blueback herring. The Savannah District consequently developed the Plan of Action to Prevent or Minimize Blueback Herring Entrainment at Hartwell and J. Strom Thurmond Dams (Exhibit H7-C). The likelihood of a fish kill is determined by the Operations Division Fisheries Biologist at the project. Operations Division has a seasonal monitoring program conducted by the Waterways Experiment Station (WES) within the lakes to detect potential fish kills. Should a fish kill occur, notification of personnel will follow the procedures of the current Plan of Action to Prevent or Minimize Blueback Herring Entrainment (most recently prepared in 1995). Power system emergencies which threaten interruption of power and/or brownouts override this policy.

In addition, water management plans are developed and enacted in conjunction with the states of Georgia and South Carolina to manage fish and

wildlife habitats.

T7-08 . *Water Supply* .

Water supply is an important consideration in the water control management of the upper Savannah River Basin. There are approximately 73 water users that obtain all or a portion of their municipal or industrial water supply from the Savannah River or from Hartwell, Russell and Thurmond Lakes.

The Water Control Manager notifies water users of any impending interruption in their water supplies due to modified project releases, and forwards periodic reports to SAD during droughts showing projected reservoir stages including a "worst case" hydrologic condition.

HEC-5 is the computer model which we have chosen to predict pool fluctuations. This model takes into account predicted inflows, and hydropower demands, as well as various operating restrictions which are imposed during drought periods.

Minimum releases are partially based on the needs of downstream water users. Several domestic and industrial users withdraw water directly from the J. Strom Thurmond lake. During period of drought minimum releases are 3600 cfs to satisfy these downstream users. (See Plate T7.10 and Exhibit M)

T7-09 . *Hydroelectric Power* .

Power is generated at J. Strom Thurmond and marketed by the Southeastern Power Administration (SEPA), as is all power produced at Federal projects (except the Tennessee Valley Authority and St. Stephens) in the states of Georgia, South Carolina, North Carolina, Virginia, Florida, Kentucky, Tennessee, West Virginia, and Alabama. SEPA combines the three Savannah District projects with seven Mobile District projects (in the Alabama-Coosa and Apalachicola-Chattahoochee-Flint Basins) to form the Georgia-Alabama-South Carolina System. Hydropower may be supplied by any combination of projects within the ten plant system. Under normal circumstances, if one basin or portion of a basin is unable to meet the power productions expected, the shortage can be transferred to, or "made up" in, another basin. SEPA markets the power through contracts negotiated with certain preference customers for the delivery of energy and the ability to meet peaking demands. Inter-basin system approach. Generation scheduling is determined by the Water Control manager on a weekly basis (see T7.02 c. above).

The installed capacity of the J. Strom Thurmond Powerhouse is seven 40-Megawatt generation units for a total generating capacity of 280 megawatts. Two station service units produce up to two megawatts which are not declared for capacity, but are included in plant discharge computations. Discharge generation curves are shown on Plates T7.8a (Units 1-7) and T7.8b (Station Service Units). A maintenance project to replace and upgrade the generation units is scheduled for Fiscal Year (FY) 1997. The design generating capacity is planned to be increased by 42 megawatts with the maximum capacity increased by 122.5 megawatts.

T7-10. *Navigation* .

The J. Strom Thurmond Project is no longer operated for navigation due to the cessation of commercial traffic on the Savannah River. Presently, the minimum flow requirement of 5800 cfs, which was authorized at the Thurmond Project for navigation on the lower Savannah River, has been superseded by minimum Thurmond discharges based on the needs of downstream water supply withdrawals.

Occasional special events downstream of J. Strom Thurmond may require control of release rates. In most cases, control of the Stevens Creek Project, and the New Savannah Bluff Lock and Dam would be utilized to attain the desired water elevations before variations in J. Strom Thurmond releases would be considered.

T7-11 . *Other* .

Incidental spills may occur for debris control (in the spillway), low flow augmentation, special or emergency drawdown, water table considerations, or to accommodate construction or testing.

T7-12 . *Deviation from Normal Regulation* .

The District Engineer occasionally receives requests to deviate from normal project regulations. Prior approval for a deviation is obtained from the South Atlantic Division (SAD) Office except as noted in subparagraph a. below. Deviation requests usually fall into the following categories:

a. *Emergencies* . Some emergencies that can be expected to occur at random times are: accidents such as drowning, and failures of the operation facilities. Necessary action under emergency conditions is taken immediately unless such action would create equal or worse conditions. The SAD Office is notified as soon as is practicable. A written confirmation showing the deviation and conditions will be furnished to SAD.

b. *Unplanned minor variations* . Unplanned variations may occur for non-emergencies. Examples of these may include construction needs for utilities or bridges, and may require a time window anywhere from a few hours to a few days.

c. *Planned deviations* . An analysis of conditions, alternatives, expected benefits, probable effects will be coordinated with SAD by telephone, fax or E-mail, along with recommendations for review and approval. Examples of planned deviations could be to prevent fish entrainment, or for drought contingencies. A copy of the Drought Contingency Plan is included as Exhibit M, while the drought plan action levels are shown on Plate T7.10

T7-13 . *Operation of New Savannah Bluff Lock and Dam* . The lock is presently operated by the Augusta-Richmond County consolidated government. The gates of the dam are operated remotely from the Thurmond Project powerhouse to maintain the recreational and water supply pool in the Augusta area.

The upper pool should normally be maintained between elevation 115 and 116 feet NGVD (gage height 14 to 15 feet), unless the necessity for maintaining minimum flow in the river downstream requires a further drawdown. The pool should not be drawn below 11.5 feet on the upper pool gage without giving advance warning to the water supply interests in the lock and dam pool to allow them to make emergency arrangements. Changes in the pool level, as well as the desired discharge downstream, determine the settings of the vertical gates.

The gates are normally set with the two overflow gates (#1 and #5) down (closed), and the three interior gate openings set according to the desired discharge. Tables describing New Savannah Bluff Lock and Dam gate settings and discharges are included in Exhibit O. These tables are taken from the Savannah River Emergency Action Plan, DP 1130-2-16, Appendix C. During flood operation, the upper pool should be maintained near elevation 114, (gage height 13.0 feet), + or - 0.5 foot. If inflows are such that the pool continues to rise, all gates are opened 1.8 feet; then 2, 2.5, 3, 4, 5, 7 and 9 feet

until all the gates are clear of the water. For falling stages the gate operation is reversed.

EXHIBIT T7-A

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL

J. STROM THURMOND DAM AND LAKE PROJECT

1. *BACKGROUND AND RESPONSIBILITIES*

a. *General Information* . These "Standing Instructions to the Project Operator for Water Control" are written in compliance with Paragraph 9-2 of Engineering Manual 1110-2-3600 (Engineering and Design, MANAGEMENT OF WATER CONTROL SYSTEMS, 30 November 1987) and with Engineer Regulation 1110-2-240 (Engineering and Design, WATER CONTROL MANAGEMENT, 8 October 1982).

(1) *Project Purposes* . The operating purposes of the J. Strom Thurmond Project, are **Recreation** , **Hydroelectric Power** , **Water Supply** , **Fish and Wildlife** , **Water Quality** , and **Flood Control** .

(2) *Chain of Command* . The Project Operator is responsible to the Water Control Manager for all water control actions.

(3) *Structure* . The J. Strom Thurmond Dam is located at Savannah River Mile 221.6, Columbia County, Georgia and McCormick County, South Carolina. The dam is a concrete gravity and earth embankment structure with a concrete gravity ogee spillway. The Thurmond Powerhouse is located on the South Carolina (east) side, immediately downstream of the dam.

(4) *Operations and Maintenance* (O&M). All O&M activities are the responsibility of the U.S. Army Corps of Engineers.

b. *Role of the Project Operator* .

(1) *Normal Conditions (dependent on day-to-day situation)* . During normal conditions, all releases will be made through the turbine units. The water control manager will coordinate the weekly water control actions with SEPA. The Project Operator will then receive instructions from SEPA. This will be increased to a daily basis if the need develops. Any special instructions on the operation of the gates at New Savannah Bluff Lock and Dam will be received directly from the water control manager.

(2) *Emergency Conditions (flood or drought)* . The Project Operator will be instructed by water control managers on a daily or hourly basis for water

control actions during flood events and other emergency conditions. In the event that communications with water control managers are cut off during a

flood event, the operator should regulate plant discharge in accordance with Plate T7.4, Flood Control Release Schedule, Plate T7.5, Spillway Gate Regulation Schedule, and Plate T7.6, Tainter Gate Rating Curves, and notify local civil defense authorities in the event that spillway releases are required.

2. ***DATA COLLECTION AND REPORTING .***

a. *Normal Conditions* . Project data is recorded hourly by the project operator. The data is retrieved hourly by the Water Control Manager and loaded into the Water Control Data System. The data is subsequently made available on the Water Management web site at http://water.sas.usace.army.mil:

(1) **Pool Elevations** in feet NGVD are collected hourly.

(2) **Basin Average Precipitation** in hundredths of an inch is estimated hourly from NWS doppler radar.

(3) **Tailwater Elevations** in feet NGVD are collected hourly.

(4) **Discharge** in cubic feet per second is collected hourly.

(5) **Inflow** to the lake in cubic feet per second is collected hourly.

(6) **Scheduled and Actual Generation** in megawatt-hours is collected hourly.

b. *Emergency Conditions* . Report hourly the elevation, turbine discharge, spillway discharge, and general project status to the Water Control Manager.

c. *Regional Hydro-meteorological Conditions* . The Project Operator will be informed by the Water Control Manager of regional hydrometeorological conditions that may/will impact the structure.

3. ***WATER CONTROL ACTION AND REPORTING*** .

a. *Normal Conditions* . The Project Operator reports directly to the Water Control Manager.

b. *Emergency Conditions* . The Project Operator will follow the Savannah River Emergency Action Plan (District Pamphlet 1130-2-16, Appendix B) for emergency notification procedures.

c. *Inquiries* . All significant inquiries received by the Project Operator from citizens, constituents or interest groups regarding water control procedures or actions must be referred directly to the Water Control Manager.

d. *Water Control Problems* . The Project Operator must immediately notify the Water Control Manager, by the most rapid means available, in the event that an operational malfunction, erosion or other incident occurs that could impact project integrity in general, or water control capability in particular. Such incidents are discussed in Appendix A of DP 1130-2-16, the Emergency Action Plan.

EXHIBIT T7-B

PERTINENT DATA

J. STROM THURMOND DAM AND LAKE

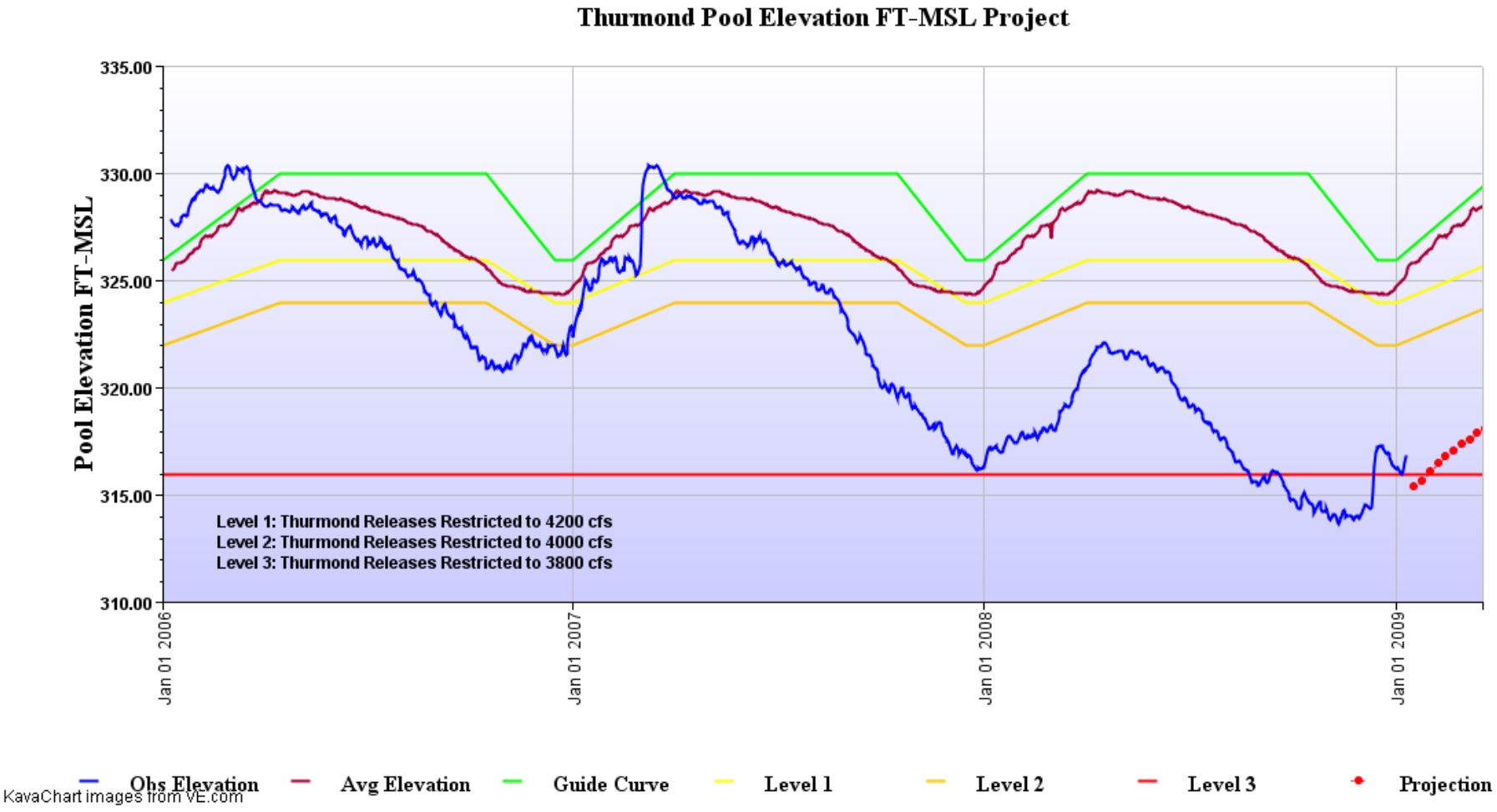
LOCATION		
In the Piedmont Area at Latitude 33o - 39' N, Longitude 82o - 11' W		
On the Savannah River:		
221.6 miles above the mouth		
207.2 miles above Savannah, Georgia		
22.0 miles above Augusta, Georgia		
37.5 miles below Richard B. Russell Dam		
67.3 miles below Hartwell Dam		
In Columbia County, Georgia and McCormick County, South Carolina 23 miles southeast of Augusta, Georgia		
DRAINAGE AREA		
.	*percentage*	*square miles*
Above the mouth of the Savannah River	100	10,579
Above Augusta, Georgia (Butler Cr. gage)	71	7,508
Above J. Strom Thurmond Dam	58	6,144
Thurmond Local Basin	.	3254
Uncontrolled local area	(Thurmond Dam to Butler Creek)	1,364
STORAGE VOLUMES	*Elevation (ft NGVD)*	*Acre-feet*
Spillway design flood	344.7	3,700,000
Standard project flood	342.1	3,450,000
Flood control pool	335.0	2,900,000
Maximum conservation pool	330.0	2,510,000
Minimum conservation pool	312.0	1,465,000

Conservation storage, usable	312 to 330	1,045,000
Flood storage	330 to 335	390,000
Surcharge storage	335 to 346	920,000
RESERVOIR AREAS		
.	*Elevation(ft NGVD)*	*Acres*
Spillway design flood	344.7	94,700
Standard project flood	342.1	90,000
Flood control pool	335.0	78,500
Maximum conservation pool	330.0	97,500
Minimum conservation pool	312.0	45,000
DAM, SPILLWAY, INTAKE AND POOL ELEVATIONS		
.	*Elevation(ft NGVD)*	
Top of dam	351.0	
Spillway design flood	344.7	
Induced surcharge pool	346.0	
Standard project flood	342.1	
Top of Tainter gates, closed	335.0	
Flood control pool	335.0	
Maximum conservation pool	330.0	
Average conservation pool	327.5	
Minimum conservation pool	312.0	
Spillway crest	300.0	
Intake invert	228.0	
Spillway bucket lip	(varies) 185.0	
Elevation, bottom of sluice	190.0	
Draft tube exit	160.0	
Bottom of draft tube	154.0	

POWERPLANT ELEVATIONS		
.	*Elevation(ft NGVD)*	
Switchyard	240.5	
Transformers	235.0	
TAILWATER ELEVATIONS		
.	*Elevation(ft NGVD)*	
Spillway design flood (1,055,000 cfs)	255.0	
Standard project flood (645,000 cfs)	240.0	
Maximum pool of record (277,000 cfs)	220.5	
7 units Operating at Average Head	193.0	
1 units Operating at Average Head	185.0	
Average Operating condition	191.0	
Streambed	176.0	
DAM, SPILLWAY AND INTAKE DIMENSIONS		
Concrete gravity and earth embankment with concrete gravity spillway		
Length of concrete sections	2,282 feet	
Length of earth embankment	3,398 feet	
Maximum height of concrete section	200 feet	
Maximum height of earth embankment	151 feet	
Length of intake section	434 feet	Sluice Gates (8)
Width of sluices	4 feet	
Height of sluices	9 feet	
Spillway		
Gross length of spillway	1,096 feet	
Length of clear opening	920 feet	
Tainter gates (23)	each 40 feet wide by 35 feet high	
Width of Gate	40 feet	

Height of Gate	35 feet	
Type of Bucket	Submerged Roller Bucket	
Radius of bucket	50 feet	
DESIGN FLOWS	*Cubic feet per second*	
Standard Project Flood (SPF)		
Peak Reservoir Inflow	645,000 cfs	
Maximum Estimated Outflow	560,000 cfs	
Spillway Design Flood		
Peak Reservoir Inflow	1,180,000 cfs	
Maximum Estimated Outflow	1,055,000 cfs	
POWERPLANT EQUIPMENT		
Conventional Operating Units	Seven	
Service Units	Two	
Maximum net operating head	152 feet	
Average operating head	136 feet	
Minimum operation head	118 feet	
Turbine capacity at average head	55,000 hp per unit	
Maximum discharge at critical head	4,920 cfs per unit	
Length of draft tube	59 feet	
GENERATORS		
Total installation	280,000 kW	
Average annual energy	698,000,000 kilowatt-hours	
Generator rating	(0.9 pf)	44,444 kva
Generator speed	100 rpm	
Generator voltage	13.8 kV	
Transformer rating,	three three-phase,	each 105,000 kva
Transformer rating,	one three-phase,	52,500 kva

Transformer voltages, kV	13.2 to 115 kv
SWITCHYARD	
Location East (South Carolina) Bank, Downstream	
Number of Bays	11
Number of Generator Bays	4
Number of Line Bays	7
Equipment voltage	115 kV


Thurmond Pool Elevation FT-MSL Project
Pool Elevation FT-MSL
335.00
330.00
325.00
320.00
315.00
310.00
Level 1: Thurmond Releases Restricted to 4200 cfs
Level 2: Thurmond Releases Restricted to 4000 cfs
Level 3: Thurmond Releases Restricted to 3800 cfs
Jan 01 2006
Jan 01 2007
Jan 01 2008
Jan 01 2009
Obs Elevation
Avg Elevation
Guide Curve
Level 1
Level 2
Level 3
Projection
KavaChart images from VE.com

	HARTWELL LEVELS				RUSSELL LEVELS	THURMOND LEVELS			
	Guide Curve	Trigger Level 1	Trigger Level 2	Trigger Level 3	Guide Curve	Guide Curve	Trigger Level 1	Trigger Level 2	Trigger Level 3
1-Jan	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
2-Jan	656.04	654.02	652.02	646.00	475.00	326.04	324.02	322.02	316.00
3-Jan	656.09	654.04	652.04	646.00	475.00	326.09	324.04	322.04	316.00
4-Jan	656.13	654.07	652.07	646.00	475.00	326.13	324.07	322.07	316.00
5-Jan	656.18	654.09	652.09	646.00	475.00	326.18	324.09	322.09	316.00
6-Jan	656.22	654.11	652.11	646.00	475.00	326.22	324.11	322.11	316.00
7-Jan	656.27	654.13	652.13	646.00	475.00	326.27	324.13	322.13	316.00
8-Jan	656.31	654.16	652.16	646.00	475.00	326.31	324.16	322.16	316.00
9-Jan	656.36	654.18	652.18	646.00	475.00	326.36	324.18	322.18	316.00
10-Jan	656.40	654.20	652.20	646.00	475.00	326.40	324.20	322.20	316.00
11-Jan	656.44	654.22	652.22	646.00	475.00	326.44	324.22	322.22	316.00
12-Jan	656.49	654.24	652.24	646.00	475.00	326.49	324.24	322.24	316.00
13-Jan	656.53	654.27	652.27	646.00	475.00	326.53	324.27	322.27	316.00
14-Jan	656.58	654.29	652.29	646.00	475.00	326.58	324.29	322.29	316.00
15-Jan	656.62	654.31	652.31	646.00	475.00	326.62	324.31	322.31	316.00
16-Jan	656.67	654.33	652.33	646.00	475.00	326.67	324.33	322.33	316.00
17-Jan	656.71	654.36	652.36	646.00	475.00	326.71	324.36	322.36	316.00
18-Jan	656.76	654.38	652.38	646.00	475.00	326.76	324.38	322.38	316.00
19-Jan	656.80	654.40	652.40	646.00	475.00	326.80	324.40	322.40	316.00
20-Jan	656.84	654.42	652.42	646.00	475.00	326.84	324.42	322.42	316.00
21-Jan	656.89	654.44	652.44	646.00	475.00	326.89	324.44	322.44	316.00
22-Jan	656.93	654.47	652.47	646.00	475.00	326.93	324.47	322.47	316.00
23-Jan	656.98	654.49	652.49	646.00	475.00	326.98	324.49	322.49	316.00
24-Jan	657.02	654.51	652.51	646.00	475.00	327.02	324.51	322.51	316.00
25-Jan	657.07	654.53	652.53	646.00	475.00	327.07	324.53	322.53	316.00
26-Jan	657.11	654.56	652.56	646.00	475.00	327.11	324.56	322.56	316.00
27-Jan	657.16	654.58	652.58	646.00	475.00	327.16	324.58	322.58	316.00
28-Jan	657.20	654.60	652.60	646.00	475.00	327.20	324.60	322.60	316.00
29-Jan	657.24	654.62	652.62	646.00	475.00	327.24	324.62	322.62	316.00
30-Jan	657.29	654.64	652.64	646.00	475.00	327.29	324.64	322.64	316.00
31-Jan	657.33	654.67	652.67	646.00	475.00	327.33	324.67	322.67	316.00
1-Feb	657.38	654.69	652.69	646.00	475.00	327.38	324.69	322.69	316.00
2-Feb	657.42	654.71	652.71	646.00	475.00	327.42	324.71	322.71	316.00
3-Feb	657.47	654.73	652.73	646.00	475.00	327.47	324.73	322.73	316.00
4-Feb	657.51	654.76	652.76	646.00	475.00	327.51	324.76	322.76	316.00
5-Feb	657.56	654.78	652.78	646.00	475.00	327.56	324.78	322.78	316.00
6-Feb	657.60	654.80	652.80	646.00	475.00	327.60	324.80	322.80	316.00
7-Feb	657.64	654.82	652.82	646.00	475.00	327.64	324.82	322.82	316.00
8-Feb	657.69	654.84	652.84	646.00	475.00	327.69	324.84	322.84	316.00
9-Feb	657.73	654.87	652.87	646.00	475.00	327.73	324.87	322.87	316.00
10-Feb	657.78	654.89	652.89	646.00	475.00	327.78	324.89	322.89	316.00
11-Feb	657.82	654.91	652.91	646.00	475.00	327.82	324.91	322.91	316.00
12-Feb	657.87	654.93	652.93	646.00	475.00	327.87	324.93	322.93	316.00
13-Feb	657.91	654.96	652.96	646.00	475.00	327.91	324.96	322.96	316.00
14-Feb	657.96	654.98	652.98	646.00	475.00	327.96	324.98	322.98	316.00
15-Feb	658.00	655.00	653.00	646.00	475.00	328.00	325.00	323.00	316.00
16-Feb	658.04	655.02	653.02	646.00	475.00	328.04	325.02	323.02	316.00

17-Feb	658.09	655.04	653.04	646.00	475.00	328.09	325.04	323.04	316.00
18-Feb	658.13	655.07	653.07	646.00	475.00	328.13	325.07	323.07	316.00
19-Feb	658.18	655.09	653.09	646.00	475.00	328.18	325.09	323.09	316.00
20-Feb	658.22	655.11	653.11	646.00	475.00	328.22	325.11	323.11	316.00
21-Feb	658.27	655.13	653.13	646.00	475.00	328.27	325.13	323.13	316.00
22-Feb	658.31	655.16	653.16	646.00	475.00	328.31	325.16	323.16	316.00
23-Feb	658.36	655.18	653.18	646.00	475.00	328.36	325.18	323.18	316.00
24-Feb	658.40	655.20	653.20	646.00	475.00	328.40	325.20	323.20	316.00
25-Feb	658.44	655.22	653.22	646.00	475.00	328.44	325.22	323.22	316.00
26-Feb	658.49	655.24	653.24	646.00	475.00	328.49	325.24	323.24	316.00
27-Feb	658.53	655.27	653.27	646.00	475.00	328.53	325.27	323.27	316.00
28-Feb	658.58	655.29	653.29	646.00	475.00	328.58	325.29	323.29	316.00
1-Mar	658.62	655.31	653.31	646.00	475.00	328.62	325.31	323.31	316.00
2-Mar	658.67	655.33	653.33	646.00	475.00	328.67	325.33	323.33	316.00
3-Mar	658.71	655.36	653.36	646.00	475.00	328.71	325.36	323.36	316.00
4-Mar	658.76	655.38	653.38	646.00	475.00	328.76	325.38	323.38	316.00
5-Mar	658.80	655.40	653.40	646.00	475.00	328.80	325.40	323.40	316.00
6-Mar	658.84	655.42	653.42	646.00	475.00	328.84	325.42	323.42	316.00
7-Mar	658.89	655.44	653.44	646.00	475.00	328.89	325.44	323.44	316.00
8-Mar	658.93	655.47	653.47	646.00	475.00	328.93	325.47	323.47	316.00
9-Mar	658.98	655.49	653.49	646.00	475.00	328.98	325.49	323.49	316.00
10-Mar	659.02	655.51	653.51	646.00	475.00	329.02	325.51	323.51	316.00
11-Mar	659.07	655.53	653.53	646.00	475.00	329.07	325.53	323.53	316.00
12-Mar	659.11	655.56	653.56	646.00	475.00	329.11	325.56	323.56	316.00
13-Mar	659.16	655.58	653.58	646.00	475.00	329.16	325.58	323.58	316.00
14-Mar	659.20	655.60	653.60	646.00	475.00	329.20	325.60	323.60	316.00
15-Mar	659.24	655.62	653.62	646.00	475.00	329.24	325.62	323.62	316.00
16-Mar	659.29	655.64	653.64	646.00	475.00	329.29	325.64	323.64	316.00
17-Mar	659.33	655.67	653.67	646.00	475.00	329.33	325.67	323.67	316.00
18-Mar	659.38	655.69	653.69	646.00	475.00	329.38	325.69	323.69	316.00
19-Mar	659.42	655.71	653.71	646.00	475.00	329.42	325.71	323.71	316.00
20-Mar	659.47	655.73	653.73	646.00	475.00	329.47	325.73	323.73	316.00
21-Mar	659.51	655.76	653.76	646.00	475.00	329.51	325.76	323.76	316.00
22-Mar	659.56	655.78	653.78	646.00	475.00	329.56	325.78	323.78	316.00
23-Mar	659.60	655.80	653.80	646.00	475.00	329.60	325.80	323.80	316.00
24-Mar	659.64	655.82	653.82	646.00	475.00	329.64	325.82	323.82	316.00
25-Mar	659.69	655.84	653.84	646.00	475.00	329.69	325.84	323.84	316.00
26-Mar	659.73	655.87	653.87	646.00	475.00	329.73	325.87	323.87	316.00
27-Mar	659.78	655.89	653.89	646.00	475.00	329.78	325.89	323.89	316.00
28-Mar	659.82	655.91	653.91	646.00	475.00	329.82	325.91	323.91	316.00
29-Mar	659.87	655.93	653.93	646.00	475.00	329.87	325.93	323.93	316.00
30-Mar	659.91	655.96	653.96	646.00	475.00	329.91	325.96	323.96	316.00
31-Mar	659.96	655.98	653.98	646.00	475.00	329.96	325.98	323.98	316.00
1-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00

10-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
23-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-Apr	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
1-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
23-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
31-May	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00

1-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
23-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-Jun	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
1-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00

23-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
31-Jul	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
1-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
23-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
31-Aug	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
1-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00

13-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
17-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
18-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
19-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
20-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
21-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
22-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
23-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
24-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
25-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
26-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
27-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
28-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
29-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
30-Sep	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
1-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
2-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
3-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
4-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
5-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
6-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
7-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
8-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
9-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
10-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
11-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
12-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
13-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
14-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
15-Oct	660.00	656.00	654.00	646.00	475.00	330.00	326.00	324.00	316.00
16-Oct	659.93	655.97	653.97	646.00	475.00	329.93	325.97	323.97	316.00
17-Oct	659.87	655.93	653.93	646.00	475.00	329.87	325.93	323.93	316.00
18-Oct	659.80	655.90	653.90	646.00	475.00	329.80	325.90	323.90	316.00
19-Oct	659.74	655.87	653.87	646.00	475.00	329.74	325.87	323.87	316.00
20-Oct	659.67	655.84	653.84	646.00	475.00	329.67	325.84	323.84	316.00
21-Oct	659.61	655.80	653.80	646.00	475.00	329.61	325.80	323.80	316.00
22-Oct	659.54	655.77	653.77	646.00	475.00	329.54	325.77	323.77	316.00
23-Oct	659.48	655.74	653.74	646.00	475.00	329.48	325.74	323.74	316.00
24-Oct	659.41	655.70	653.70	646.00	475.00	329.41	325.70	323.70	316.00
25-Oct	659.34	655.67	653.67	646.00	475.00	329.34	325.67	323.67	316.00
26-Oct	659.28	655.64	653.64	646.00	475.00	329.28	325.64	323.64	316.00
27-Oct	659.21	655.61	653.61	646.00	475.00	329.21	325.61	323.61	316.00
28-Oct	659.15	655.57	653.57	646.00	475.00	329.15	325.57	323.57	316.00
29-Oct	659.08	655.54	653.54	646.00	475.00	329.08	325.54	323.54	316.00
30-Oct	659.02	655.51	653.51	646.00	475.00	329.02	325.51	323.51	316.00
31-Oct	658.95	655.48	653.48	646.00	475.00	328.95	325.48	323.48	316.00
1-Nov	658.89	655.44	653.44	646.00	475.00	328.89	325.44	323.44	316.00
2-Nov	658.82	655.41	653.41	646.00	475.00	328.82	325.41	323.41	316.00
3-Nov	658.75	655.38	653.38	646.00	475.00	328.75	325.38	323.38	316.00

4-Nov	658.69	655.34	653.34	646.00	475.00	328.69	325.34	323.34	316.00
5-Nov	658.62	655.31	653.31	646.00	475.00	328.62	325.31	323.31	316.00
6-Nov	658.56	655.28	653.28	646.00	475.00	328.56	325.28	323.28	316.00
7-Nov	658.49	655.25	653.25	646.00	475.00	328.49	325.25	323.25	316.00
8-Nov	658.43	655.21	653.21	646.00	475.00	328.43	325.21	323.21	316.00
9-Nov	658.36	655.18	653.18	646.00	475.00	328.36	325.18	323.18	316.00
10-Nov	658.30	655.15	653.15	646.00	475.00	328.30	325.15	323.15	316.00
11-Nov	658.23	655.11	653.11	646.00	475.00	328.23	325.11	323.11	316.00
12-Nov	658.16	655.08	653.08	646.00	475.00	328.16	325.08	323.08	316.00
13-Nov	658.10	655.05	653.05	646.00	475.00	328.10	325.05	323.05	316.00
14-Nov	658.03	655.02	653.02	646.00	475.00	328.03	325.02	323.02	316.00
15-Nov	657.97	654.98	652.98	646.00	475.00	327.97	324.98	322.98	316.00
16-Nov	657.90	654.95	652.95	646.00	475.00	327.90	324.95	322.95	316.00
17-Nov	657.84	654.92	652.92	646.00	475.00	327.84	324.92	322.92	316.00
18-Nov	657.77	654.89	652.89	646.00	475.00	327.77	324.89	322.89	316.00
19-Nov	657.70	654.85	652.85	646.00	475.00	327.70	324.85	322.85	316.00
20-Nov	657.64	654.82	652.82	646.00	475.00	327.64	324.82	322.82	316.00
21-Nov	657.57	654.79	652.79	646.00	475.00	327.57	324.79	322.79	316.00
22-Nov	657.51	654.75	652.75	646.00	475.00	327.51	324.75	322.75	316.00
23-Nov	657.44	654.72	652.72	646.00	475.00	327.44	324.72	322.72	316.00
24-Nov	657.38	654.69	652.69	646.00	475.00	327.38	324.69	322.69	316.00
25-Nov	657.31	654.66	652.66	646.00	475.00	327.31	324.66	322.66	316.00
26-Nov	657.25	654.62	652.62	646.00	475.00	327.25	324.62	322.62	316.00
27-Nov	657.18	654.59	652.59	646.00	475.00	327.18	324.59	322.59	316.00
28-Nov	657.11	654.56	652.56	646.00	475.00	327.11	324.56	322.56	316.00
29-Nov	657.05	654.52	652.52	646.00	475.00	327.05	324.52	322.52	316.00
30-Nov	656.98	654.49	652.49	646.00	475.00	326.98	324.49	322.49	316.00
1-Dec	656.92	654.46	652.46	646.00	475.00	326.92	324.46	322.46	316.00
2-Dec	656.85	654.43	652.43	646.00	475.00	326.85	324.43	322.43	316.00
3-Dec	656.79	654.39	652.39	646.00	475.00	326.79	324.39	322.39	316.00
4-Dec	656.72	654.36	652.36	646.00	475.00	326.72	324.36	322.36	316.00
5-Dec	656.66	654.33	652.33	646.00	475.00	326.66	324.33	322.33	316.00
6-Dec	656.59	654.30	652.30	646.00	475.00	326.59	324.30	322.30	316.00
7-Dec	656.52	654.26	652.26	646.00	475.00	326.52	324.26	322.26	316.00
8-Dec	656.46	654.23	652.23	646.00	475.00	326.46	324.23	322.23	316.00
9-Dec	656.39	654.20	652.20	646.00	475.00	326.39	324.20	322.20	316.00
10-Dec	656.33	654.16	652.16	646.00	475.00	326.33	324.16	322.16	316.00
11-Dec	656.26	654.13	652.13	646.00	475.00	326.26	324.13	322.13	316.00
12-Dec	656.20	654.10	652.10	646.00	475.00	326.20	324.10	322.10	316.00
13-Dec	656.13	654.07	652.07	646.00	475.00	326.13	324.07	322.07	316.00
14-Dec	656.07	654.03	652.03	646.00	475.00	326.07	324.03	322.03	316.00
15-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
16-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
17-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
18-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
19-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
20-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
21-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
22-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
23-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
24-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
25-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00

26-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
27-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
28-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
29-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
30-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00
31-Dec	656.00	654.00	652.00	646.00	475.00	326.00	324.00	322.00	316.00