


S. S. W. W.

DESCRIPTION OF PUMPING STATIONS
1921.

VOL. I

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ENGINEER.

SOUTH STAFFORDSHIRE WATERWORKS COMPANY.

PUMPING STATIONS.

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BOURNE VALE PUMPING STATIONsituate nearAIDRIDGE in the County of STAFFORD.S U M M A R Y

Total Engine Power at Station
is equal to 2½ million gallons
per 24 hours.

No. 1. Engine. Power per day, = 1,000,000 Galls
No. 2. Engine. ditto = 1,500,000 "

SPECIFIED HEAD. No. 1. Engine - 450 Feet
No. 2. Engine - 480 "

C O S T S

	<u>£.</u>	<u>s.</u>	<u>d.</u>
Land and Law Charges ...	1,027.	15.	9.
Making Well ...	1,492.	0.	0.
Borehole in Well ...	468.	17.	9.
Engine & Boiler Houses ...	5,669.	14.	9.
Cottages ...	1,536.	1.	4.
2 Engines, 3 Boilers ...	9,103.	16.	4.
Sundries and Fencing ...	832.	0.	0.
VENTURI RECORDERS.	569.	0.	0.
ELECTRIC WATER LEVEL INDICATOR.	174.	18.	6
<u>TOTAL COST</u>	<u>£ 20,874.</u>	<u>4.</u>	<u>5.</u>

Station Commenced - 1892.

Station Completed - 1898.

LAND (1 ACRE)

Purchased from Hon. E.S. Parker Jarvis,
in January, 1892.

Level E.H.F. above O.D. ... 424.33 Feet.

CONTRACTORS

WELL

Sunk by South Staffordshire) 1892 - 1895.
Waterworks Company.)

BOREHOLE

Sunk by E. Chapman & Sons, 1897 - 1898.

BUILDINGS

Engine & Boiler Houses.

T. Lowe & Sons, ... 1893 - 1894.

Cottages.

T. Lowe & Sons, ... 1894 - 1895.

ENGINES.

No. 1. Engine & 3 Boilers.

Harvey & Co. Ltd, Hayle, 1894.

No. 2. Engine.

Fawcett, Preston & Co, 1896.
Liverpool.

C O S T S

		£	s	d
Land and Law Charges	...	1,027.	15.	9
Making Well	... ..	1,492.	0.	0
Borehole in Well ..	...	468.	17.	9
Engine & Boiler Houses	...	5,669.	14.	9
Five Cottages	... ..	1,536.	1.	4
■ No. 1. Engine & Boilers	...	4,135.	15.	0
No. 2. Engine	... ..	4,968.	1.	4
Fencing and Sundries	... ..	832.	0.	0
VENTURI RECORDER AND WATER		743.	18	6
LEVEL INDICATOR.	<u>TOTAL</u>	£ 20,874	4.	5

COSTS (Continued)Details of Cost of No. 1. Engine.

Engine & Pumps only	£ 3,069.	15.	0.
Three Boilers, ..	806.	0.	0.
1 - 10 Ton Overhead) Crane)	260.	0.	0.
	<u>£ 4,135.</u>	<u>15.</u>	<u>0.</u>

ENGINE HOUSE.

Internal Dimensions	...	
Length	...	40 Ft - 0 Ins.
Width	...	32 Ft - 0 Ins.
Height to top of Wall Plate		30 Ft - 0 Ins.
Depth of Foundations	...	14 Ft - 3 Ins.

BOILER HOUSE.

Internal Dimensions.		
Length	...	48 Ft - 10 $\frac{1}{2}$ Ins.
Width	...	28 Ft - 7 $\frac{1}{2}$ Ins.
Height to top of Wall Plate		19 Ft - 6 Ins.

WELL AND BOREHOLE.

Diameter, Well	...	12 Ft - 0 Ins.
Depth " from E.H.F. ..		89 Ft - 0 Ins.
Borehole in centre of Well .		13 $\frac{1}{2}$ Ins. dia.
Total Depth, Borehole and Well) combined)		251 Feet

Top part of Borehole

lined with W.I. Tubing, 13 $\frac{1}{2}$ Ins. inside diameter, $\frac{1}{2}$ inch thick, to a depth of (from E.H.F.) ...		130 Feet
Lining Tubes project from bottom of Well a distance of		6 Ft - 9 Ins.
Top of Well from E.H.F. ...		14 Ft - 3 Ins.

NO. 1. ENGINE.Compound Vertical Surface-Condensing
Marine Type.CAPACITY

Net Quantity equals 1,000,000 Gallons
per 24 hours at 140 feet per Minute.

SPECIFIED HEAD

Depth of Well	... ..	100 Feet
Head on Delivery Main, including)		350 Feet
friction)		---
	<u>TOTAL SPECIFIED HEAD</u>	450 Feet
		===
Engine Speed per Minute	... ..	17½
Pump Horse Power at 17½ Revolutions,		94.5.

RISING MAIN OR LIFTS.

Number, Lifts to Engine	... ..	2
Distance apart	... ..	5 Feet.
Diameter, Lifts	... ..	13½ Ins.
Length each Pipe	... ..	9 Feet
Thickness do	... ..	¾ In.
Diameter, Flanges on Pipes	... ..	21 Ins.

Each Lift consists of 12 C.I. Pipes,
including Working Barrel, Clack Box,
Sliding Piece, Top Length, and Snore
or Strainer. The top of each Lift is
fitted with Sliding Pipes to allow
length of Lift to be adjusted.

WORKING BARRELS

Diameter	12½ Ins.
Length	9 Feet
Thickness, Metal	1½ In.

CLACK BOXES.

Diameter, (Smallest Part)	13½ Ins.
Length	4 Ft - 6 Ins
Thickness, Metal	1½ In.
Diameter, Flanges	21 Ins.

CAST IRON STRAINERS

Diameter	13½ Ins.
Length	9 Feet
Number holes in bottom	110
Diameter, holes	1¼ Ins.
" Flanges on Strainer	21 Ins.

STEAM CYLINDERS

Diameter, H.P.	23 Ins.
" L.P.	41 Ins.
Stroke of Engine	4 Feet

Cylinders are Steam Jacketted.

PISTON RINGS

Ramsbottom type.

PISTON RODS

Diameter	5½ Ins.
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Packings. 1½ Square Asbestos

Packing of Tuck's make.

ENGINE VALVE GEAR.

Ordinary Slide Valve type, worked
from Crankshaft by Eccentrics and Rods.

VALVE GEAR (Continued)

Diameter, H.P. Valve Spindle ...	2½	Ins.
" L.P. ditto ...	2½	Ins.

AIR PUMP

One Single-Acting Pump working
off Crankshaft.

Diameter... ..	17	Ins.
Stroke	20	Ins.
Foot Valve, Number Valves on Plate.	5	
Head " ditto ...	5	
Number, Valves on Bucket ...	5	
Diameter, Gunmetal Guards ...	3½	Ins.
" Bucket Rod ...	2½	Ins.
Diameter Inlet	9	Ins.
" Outlet	5	Ins.

Valves - "Ringhorn" Metallic

Packing - Round Air Pump Bucket

¾ Inch Hemp.

WELL PUMPS.

Pumps actuated by side levers off the
Engine Crossheads.

WELL PUMP BUCKET & SUCTION VALVE.

Cast Iron Double-Beat Buckets. Cast Iron

Suction Valves (Hat-Band Type)

Diameter, W.P. Bucket ...	12½	Ins.
Stroke do ...	4	Feet
Depth Gutta-Percha Gearing ...	3	Ins.
Diameter, W.P. Rods ...	1½	Ins.
" top do ...	1½	Ins.

W.P. Bucket & Suction Valve (Continued)

Number W.P. Guides in one Lift ...	3
Diameter ditto ...	12 $\frac{1}{2}$ Ins.

W.P. Rod Couplings - Clasp Joint
secured with 2 Collars.

FORCE PUMPS

Single-Acting Plunger, worked by
side Rods from Engine Crosshead.

Diameter, Plungers ...	12 $\frac{1}{2}$ Ins.
Stroke do ...	4 Feet
Capacity of one Plunger ...	21.3 Galls.
Gallons discharged per rev. ...	42.6
Multiplier given to Foreman ...	42
Excess of discharge of Well Pumps) over Force Pumps)	None.

FORCE PUMP VALVES.

Cast Iron Double Beat Valves

Number, Suction & Delivery Valves,	2 Each.
Diameter, Seat of ditto	17 $\frac{1}{2}$ Ins.
Free Lift of Valves ...	1 $\frac{1}{2}$ Ins.

CONDENSER.

Open type with Solid Drawn Brass
Tubes, secured in Gunmetal Tube -
Plate by Wood Ferrules. Condenser
placed in Force Pump Suction Tank.

Cooling Surface ...	259.78 Sq. Ft
Ordinary Tubes. Number ...	105.
Length ...	4 Ft - 2 Ins.
Diameter ...	2 $\frac{3}{8}$ In.
Thickness ...	14 B.W.G.

CONDENSER (Continued)

Stay Tubes, Number	...	...	4
Diameter	...	2	In. Bore.
Thickness	...	3	$\frac{1}{16}$ In.
Length	...	4	Ft - $3\frac{1}{2}$ Ins
Pitch	...	3	$\frac{1}{2}$ Ins.
Distance over Tube Plates	...	4	Ft - $0\frac{1}{2}$ Ins
Thickness do	...	1	$\frac{1}{4}$ Ins.
Diameter, Inlet	...	9	Ins.
" Outlet	...	9	Ins.

DELIVERY AIR VESSEL. (CAST IRON)

Total height inside	...	8	Feet
Diameter "	...	3	Feet
Height above Branches	...	6	Ft - 7 Ins.
Thickness, Metal	...	2	$\frac{1}{2}$ Ins.
Working pressure per sq. inch	...	165	Lbs.
Capacity above Branches	...	46.5	C. Ft.
Total Capacity	...	56.5	C. Ft

FLYWHEEL.

Diameter, Wheel	...	14	Feet
Width of Rim	...	13	Ins.
Internal Diameter, Boss	...	13	Ins.
Diameter, Crank Shaft	...	11	Ins.
" Crank Pins	...	9	$\frac{1}{2}$ Ins.
Cranks set at	...	120	$^{\circ}$

TRAVELLING CRANE (OVERHEAD)

Made by - C. Gibbons & Co.,

Birmingham.

Load	...	10	Tons.
Span	...	31	Ft - 6 Ins
Top Crane Rail to E.H.F.	...	25	FT (about)

AIR COMPRESSOR

Single-Stage - Made by The
Westinghouse Brake Co., London.

" Westinghouse" type. Size, 8/4
Class "F"

Steam Inlet, Diameter, ...	1 Inch.
Exhaust Outlet, " ...	1 1/4 Ins.
Air Delivery, " ...	3/4 In.
Maker's Number on Name Plate ...	56508.
ditto (London Works) ..	20358.

FEED PUMPS 2

"A" Type, Duplex and Horizontal.

Made by Tangyes Ltd, Birmingham.

Diameter, Steam Cylinders ...	4 1/2 Ins.
" Pumps	2 3/4 Ins.
Stroke	4 Ins.
Number Pump purchased, 1921 ...	21814.

STEAM TRAP ON STEAM RANGE

"Float" Type, made by Lancaster
and Tonge.

Size	1 In.
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LUBRICATORS.

One Sight Feed "Victor" Single-Connection
type made by C. Winn & Co. of Birmingham.

Capacity	1/3 Pint.
Number stamped on Lubricator ...	3480

STEAM BOILERS 3

"Lancashire" Type, made by
Harvey & Co, Hayle.

STEAM BOILERS (Continued)

Diameter	...	...	6 Ft - 6 Ins.
Length	...	...	28 Feet
Thickness, Shell Plate	...	...	7/16 In.
" End Plate	...	...	9/16 In.
Diameter, Internal Flues.			
Front End	...	...	30 Ins.
Thickness of Flues.			
Front End Section,			$\frac{3}{8}$ In.
Intermediate "			$\frac{3}{8}$ In.
Back End "			7/16 In.
Diameter Circular Manhole,			16 Ins.
Working pressure, per sq. inch,			60 Lbs.
Test pressure	ditto		113 "
Heating Surface	...	...	797 Sq. Ft.

STEAM MOUNTINGS ON EACH BOILER

One Cast Iron Junction Stop Valve,	5 Ins dia.
One G.M. Blow-down Cock	... 2. Ins "
One Hopkinson's Check Feed Valve,	2 $\frac{1}{2}$ Ins "
One Spring & Weight Safety Valve,	4 $\frac{1}{2}$ Ins "
Two Sets Hopkinson's Equilibrium	
Water Gauges, Figure, 6545.	$\frac{3}{4}$ In. "

COMPLETE TRIAL, 1st April, 1898.

Duration of Trial	...	24 hours
Duty of Engine (per cwt slack consumed)		56,166,724 Ft Lb
Pump Horse Power	...	88.94
Indicated Horse Power	...	111.4
Slack Consumed per P.H.P. p.hr.		4.98 lbs.
ditto I.H.P. do		3.97 "
Mechanical Efficiency	...	79.83 %

This Engine is placed in the same house as Engine No. 1., and draws water from the same well.

Compound Vertical Surface-Condensing

Marine type.

Builder's Order No. - 4126.

CAPACITY

Net Quantity equals 1,500,000 Gallons per 24 hours at 140 Ft. per Minute.

SPECIFIED HEAD

Depth of Well	...	...	100 Feet
Head on Delivery Main (including friction)			380 "
TOTAL SPECIFIED HEAD			480 "
Speed per Minute	...	...	17 $\frac{1}{2}$ Revs.
Pump Horse Power	...	...	151

RISING MAIN OR LIFTS

Distance apart	...	...	5 Feet
Number, Lifts to Engine		...	2
Diameter, Cast Iron Lift	...	...	18 Ins.
Length each Pipe	...	...	9 Feet
Thickness do	...	...	1 Inch.
Diameter, Flanges on Pipes	...	...	26 Ins.

Each Lift consists of 10 Pipes including Top Length, Sliding Pipes, Inspection & Clack Boxes, Working Barrel, Suction Pipe and Snore Piece.

WORKING BARRELS

Diameter	...	...	...	16	Ins.
Length	...	...	...	5 Ft - 9	Ins.
Thickness of Metal	...	...	...	1 $\frac{3}{8}$	In.
Diameter, Flanges	...	...	...	28	Ins.

CLACK BOXES

Diameter, Smallest Part)	...	...	...	18	Ins.
Length	...	...	...	4 Ft - 2 $\frac{1}{2}$	Ins
Thickness, Metal	...	...	...	1 $\frac{1}{2}$	Ins.
Diameter, top Flange	...	...	...	28	Ins.
" bottom "	...	...	...	23 $\frac{1}{2}$	Ins.

SNORE PIECES (CAST IRON)

Diameter at Neck	...	...	...	15	Ins.
Length	...	...	...	2 Ft - 6	Ins.

INSPECTION BOXES FOR WELL PUMP BUCKETS.

Diameter	...	...	...	18	Ins.
Length	...	...	...	5 Ft - 2	Ins.
Diameter, Flanges	...	...	...	28	Ins.
Size Opening in side of Boxes	...	...	...	18" X 28	Ins.

STEAM CYLINDERS.

Diameter, H.P.	...	...	...	29	Ins.
" L.P.	...	...	...	50	Ins.
Stroke of Engine	...	...	...	4	Feet

Cylinders are Steam Jacketted.

PISTON RINGS.

H.P. Piston	-	Ramsbottom Rings.	
L.P. "	-	Mather & Platt's Patent Springs and Rings.	
Diameter of Piston Rods	...	5	Ins.

PISTON ROD PACKINGS.

Made by - The United States Metallic
Packing Co. Ltd. Bradford.

ENGINE VALVE GEAR

Ordinary Slide Valve, worked from
Crank Shaft by Eccentrics and Rods.

Diameter, H.P. Slide Valve Spindle,	2 $\frac{1}{2}$	Ins.
" H.P. Expansion Valve do	1 $\frac{7}{8}$	In.
" L.P. ditto	2	Ins.
" L.P. Slide Valve do	2 $\frac{1}{2}$	Ins.

AIR PUMP.

One Single-Acting Pump working
off Crank Shaft.

Diameter	24	Ins.
Stroke	18	Ins.
Number, India Rubber Valves on Head) Valve)	5	
" ditto Bucket "	5	
" ditto Foot "	4	
Diameter, Valves	7	Ins.
Thickness "	9/16	"
Diameter Bucket Rod (Delta Metal)	3	Ins.
" Water Inlet	8	Ins.
" Outlet	5	Ins.

WELL PUMPS

Pumps actuated by side levers
off the Engine Crossheads.

WELL PUMP BUCKET & CLACK.

Cast Iron Double-Beat with Gun-
metal Beats for W.P. Bucket -
Gutta-Percha Bears for Clack.

W.P. BUCKET & CLACK (Continued)

Diameter, Bucket	16 Ins.
Stroke do	4 Feet
Depth Gutta-Percha Gearing ...	3 Ins.
Diameter, top Tapered Seat of Clack,	15 $\frac{3}{8}$ Ins.
Free Lift, Valve on Clack ...	1 In.
Diameter, W.P. Rods ...	2 $\frac{1}{2}$ Ins.
Number, Well Pump Guides ...	0
Well Pump Rod Couplings - Tapered.	

FORCE PUMPSPiston and Plunger Type.

Diameter, Piston	16 Ins.
" Plunger	11 $\frac{3}{8}$ Ins.
Stroke Force Pump	4 Feet
Capacity, One Pump ...	34.9 Galls.
Gallons discharged per rev. ...	69.8
Multiplier given to Foreman ...	69
Excess, Discharge of Well Pumps) over Force Pumps ...)	None

FORCE PUMP VALVES.Cast Iron Valves with Gutta-
percha Beats.

Number, Suction & Delivery Valves,	2 Each.
Ext. Diameter, Flange on Seat,	26 $\frac{1}{2}$ Ins.
Free lift of Valves ...	1 Inch.

CONDENSER.

Open type with Tubes expanded
into Cast Iron Water Ends.

Condenser placed in Force Pump
Suction Tank.

CONDENSER (Continued).

Cooling Surface	...	...	362 Sq. Ft.
Ordinary Tubes. Number	...	...	211
	Length	...	5 Ft - 6½ Ins
	Diameter	...	1½ In. Bore.
	Thickness	...	15 B.W.G.
	Pitch	...	3½ Ins.
Distance over Cast Iron Ends	...	...	5 Ft - 6 Ins.
Thickness	ditto	...	1½ Ins.
Diameter, Inlet	...	...	12 Ins.
" Outlet	...	...	8 Ins.

NOTE:- No Tube Plates with this
Condenser, Tubes are expanded
into Cast Iron Ends.

DELIVERY AIR VESSEL

Top Part - Mild Steel.

Bottom Part - Cast Iron.

Total height inside	...	...	10 Feet
Diameter	"	...	3 Feet
Height above Branches	...	...	7 Ft - 6 Ins.
Thickness, Mild Steel Portion	...	...	½ In.
Working Pressure per Sq. Inch	...	...	165 Lbs.
Capacity above Branches	...	...	53 C. Ft.
Total Capacity	...	...	71 C. Ft.

FLYWHEEL. (CAST IRON)

Diameter, Wheel	...	...	17 Feet
Width of Rim	...	...	17 Ins
Internal Diameter, Boss	...	...	14½ Ins.
Number, Segments in Wheel	...	...	6
Diameter, Crank Shaft & Crank Pins,	...	...	10½ Ins each.

FEED PUMP ON MAIN ENGINE

Plunger Type worked off Crank
Shaft.

Diameter, Plunger	...	...	3 $\frac{1}{2}$ Ins.
Stroke, Pump	...	...	18 Ins.

FEED WATER FILTER ON FEED MAIN

Railton & Campbell's Patent, made by
D. Crawford & Co., Engineers, Liverpool.

This Filter is not used at present.

AIR CHARGER ON MAIN ENGINE.

Plunger Type worked off Crank
Shaft.

Diameter, Plunger	...	...	3 $\frac{1}{2}$ Ins.
Stroke do	...	...	18 Ins
Height Delivery Main Pressure Gauge			
from E.H.F.	...	...	5 Feet

TRIAL OF ENGINE, 8th MARCH, 1898.

Duration of Trial	...	...	24 Hours.
Duty of Engine, per cwt of Slack)			70,975,071 Ft. Lbs
consumed)			
Pump Horse Power	...	...	143.93
Indicated Horse Power	...	...	160.51
Slack consumed per P.H.P. per hour,			3.48 Lbs
ditto I.H.P. do			3.12 "
Mechanical Efficiency	...	...	89.67 %