

RSK LDE		Page 0
14 Beecham Court Pemberton Business Park Wigan WN3 6PR		
Date 01/01/0001	Designed by LSteedman	
File SN1 - DETAILED DESIGN JU...	Checked by	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SN1 JUN 25.SWS

Pipe Sizes SN1 SEP 24 Manhole Sizes SN1 SEP 24

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	1999
Site Location GB 401500 343900 SK 01500 43900	
C (1km)	-0.028
D1 (1km)	0.388
D2 (1km)	0.309
D3 (1km)	0.349
E (1km)	0.302
F (1km)	2.337
Maximum Rainfall (mm/hr)	250
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	400

Designed with Level Soffits

Time Area Diagram for SN1 JUN 25.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.099	4-8	1.082	8-12	0.032

Total Area Contributing (ha) = 2.213

Total Pipe Volume (m³) = 741.821

Network Design Table for SN1 JUN 25.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
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Network Design Table for SN1 JUN 25.SWS Network Results Table <table><tr><th>PN</th><th>Rain</th><th>T.C.</th><th>US/IL</th><th>Σ I</th><th>Area</th><th>Σ Base</th><th>Foul</th><th>Add Flow</th><th>Vel</th><th>Cap</th><th>Flow</th></tr><tr><th></th><th>(mm/hr)</th><th>(mins)</th><th>(m)</th><th></th><th>(ha)</th><th>Flow (l/s)</th><th>(l/s)</th><th>(l/s)</th><th>(m/s)</th><th>(l/s)</th><th>(l/s)</th></tr></table>			PN	Rain	T.C.	US/IL	Σ I	Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow		(mm/hr)	(mins)	(m)		(ha)	Flow (l/s)	(l/s)	(l/s)	(m/s)	(l/s)	(l/s)
PN	Rain	T.C.	US/IL	Σ I	Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow															
	(mm/hr)	(mins)	(m)		(ha)	Flow (l/s)	(l/s)	(l/s)	(m/s)	(l/s)	(l/s)															
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Network Design Table for SN1 JUN 25.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	21.767	0.109	199.7	0.123	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	16.491	0.082	201.1	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	87.879	2.448	35.9	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	15.609	0.066	238.0	0.176	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	21.351	0.090	238.0	0.021	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	16.585	0.070	238.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	30.889	0.080	385.0	0.261	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	31.735	0.082	385.0	0.074	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	10.225	0.027	385.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	48.808	2.943	16.6	0.145	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	68.568	0.171	400.0	0.436	5.00	0.0	0.600	o	1500	Pipe/Conduit	
3.001	34.069	0.085	400.0	0.019	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.007	37.179	0.093	400.0	0.097	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.008	22.212	0.056	400.0	0.018	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.009	5.227	0.013	400.0	0.035	0.00	0.0	0.600	o	1500	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	58.87	5.33	166.108	0.123	0.0	0.0	0.0	1.11	78.4	26.1
1.001	57.20	5.58	165.999	0.133	0.0	0.0	0.0	1.11	78.1	27.5
1.002	53.86	6.13	165.917	0.213	0.0	0.0	0.0	2.63	186.1	41.4
2.000	59.37	5.26	163.694	0.176	0.0	0.0	0.0	1.01	71.7	37.7
2.001	57.00	5.61	163.628	0.197	0.0	0.0	0.0	1.01	71.7	40.5
2.002	55.31	5.88	163.539	0.197	0.0	0.0	0.0	1.01	71.7	40.5
1.003	51.26	6.63	163.319	0.671	0.0	0.0	0.0	1.03	163.8	124.2
1.004	48.91	7.15	163.239	0.745	0.0	0.0	0.0	1.03	163.8	131.6
1.005	48.20	7.31	163.156	0.745	0.0	0.0	0.0	1.03	163.8	131.6
1.006	47.54	7.47	163.130	0.890	0.0	0.0	0.0	5.01	797.0	152.8
3.000	57.47	5.53	159.393	0.436	0.0	0.0	0.0	2.14	3779.1	90.5
3.001	55.79	5.80	159.222	0.455	0.0	0.0	0.0	2.14	3779.1	91.7
1.007	46.41	7.76	159.136	1.442	0.0	0.0	0.0	2.14	3779.1	241.7
1.008	45.77	7.94	159.043	1.460	0.0	0.0	0.0	2.14	3779.1	241.7
1.009	45.62	7.98	158.988	1.495	0.0	0.0	0.0	2.14	3779.1	246.3

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<u>Simulation Criteria for SN1 JUN 25.SWS</u> <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Summer</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>1.000</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.356</td> <td></td> <td></td> </tr> </table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	2	Cv (Summer)	1.000	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.356		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	2	Cv (Summer)	1.000																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	18.000	Storm Duration (mins)	30																			
Ratio R	0.356																					
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Online Controls for SN1 JUN 25.SWS

Hydro-Brake® Optimum Manhole: 23, DS/PN: 1.013, Volume (m³): 74.3

Unit Reference	MD-SHE-0167-1740-2350-1740
Design Head (m)	2.350
Design Flow (l/s)	17.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	167
Invert Level (m)	158.785
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.350	17.4	Kick-Flo®	1.408	13.6
Flush-Flo™	0.679	17.4	Mean Flow over Head Range	-	15.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	15.8	3.000	19.5	7.000	29.3
0.200	13.8	1.400	13.8	3.500	21.0	7.500	30.3
0.300	15.6	1.600	14.5	4.000	22.4	8.000	31.3
0.400	16.5	1.800	15.3	4.500	23.7	8.500	32.2
0.500	17.1	2.000	16.1	5.000	25.0	9.000	33.1
0.600	17.3	2.200	16.9	5.500	26.1	9.500	34.0
0.800	17.3	2.400	17.6	6.000	27.2		
1.000	16.8	2.600	18.2	6.500	28.3		

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 401500 343900 SK 01500 43900
C (1km)	-0.028
D1 (1km)	0.388
D2 (1km)	0.309
D3 (1km)	0.349
E (1km)	0.302
F (1km)	2.337
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1 15	Summer	2	+0%	100/15	Summer			166.223
1.001	2 15	Summer	2	+0%	100/15	Summer			166.120
1.002	3 15	Summer	2	+0%	100/15	Summer			166.005
2.000	4 15	Summer	2	+0%	30/15	Summer			163.846
2.001	5 15	Summer	2	+0%	30/15	Summer			163.785
2.002	6 15	Summer	2	+0%	30/15	Summer			163.697

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)					
1.000	1	-0.185	0.000	0.31		21.2	OK	
1.001	2	-0.179	0.000	0.34		22.7	OK	
1.002	3	-0.212	0.000	0.18		33.2	OK	
2.000	4	-0.148	0.000	0.50		6 30.3	OK	
2.001	5	-0.144	0.000	0.53		33.4	OK	
2.002	6	-0.142	0.000	0.54		33.1	OK	



2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

									Water
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow
PN	Name	Storm	Period		Change	Surcharge	Flood	Overflow	Act.
									Level
									(m)
1.003	7	15	Summer	2	+0%	30/15	Summer		163.631
1.004	8	15	Summer	2	+0%	30/15	Summer		163.571
1.005	9	15	Summer	2	+0%	30/15	Summer		163.514
1.006	10	15	Summer	2	+0%				163.249
3.000	11	480	Summer	2	+0%	100/240	Summer		159.748
3.001	12	480	Summer	2	+0%	100/120	Summer		159.748
1.007	13	480	Summer	2	+0%	100/60	Summer		159.748
1.008	14	360	Summer	2	+0%	100/60	Summer		159.747
1.009	15	360	Summer	2	+0%	100/60	Summer		159.746
4.000	16	480	Summer	2	+0%	100/120	Summer		159.745
4.001	17	480	Summer	2	+0%	100/60	Summer		159.745
4.002	18	360	Summer	2	+0%	100/60	Summer		159.745
1.010	19	360	Summer	2	+0%	100/30	Summer		159.746
5.000	20	480	Summer	2	+0%	100/60	Summer		159.743
1.011	21	480	Summer	2	+0%	100/30	Summer		159.743
1.012	22	480	Summer	2	+0%	100/30	Summer		159.740
1.013	23	480	Summer	2	+0%	2/15	Summer		159.737

PN	US/MH	Depth	Volume	Flow /	Half Drain	Pipe	Status	Level
	Name	(m)	(m³)	Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.003	7	-0.138	0.000	0.69			97.2	OK
1.004	8	-0.118	0.000	0.71			100.8	OK
1.005	9	-0.093	0.000	0.98			99.7	OK
1.006	10	-0.330	0.000	0.16			114.0	OK
3.000	11	-1.145	0.000	0.01			15.5	OK
3.001	12	-0.973	0.000	0.00			10.5	OK
1.007	13	-0.888	0.000	0.02			40.1	OK
1.008	14	-0.797	0.000	0.02			39.9	OK
1.009	15	-0.742	0.000	0.02			36.5	OK
4.000	16	-1.014	0.000	0.00			5.1	OK
4.001	17	-0.897	0.000	0.00			3.3	OK
4.002	18	-0.780	0.000	0.00			5.0	OK
1.010	19	-0.729	0.000	0.01			24.8	OK
5.000	20	-0.804	0.000	0.00			5.6	OK
1.011	21	-0.692	0.000	0.01			20.1	OK
1.012	22	-0.626	0.000	0.01			18.1	OK
1.013	23	0.727	0.000	0.18			16.7	SURCHARGED

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 401500 343900 SK 01500 43900
C (1km)	-0.028
D1 (1km)	0.388
D2 (1km)	0.309
D3 (1km)	0.349
E (1km)	0.302
F (1km)	2.337
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1 15	Summer	30	+0%	100/15	Summer			166.310
1.001	2 15	Summer	30	+0%	100/15	Summer			166.217
1.002	3 15	Summer	30	+0%	100/15	Summer			166.073
2.000	4 15	Summer	30	+0%	30/15	Summer			164.634
2.001	5 15	Summer	30	+0%	30/15	Summer			164.555
2.002	6 15	Summer	30	+0%	30/15	Summer			164.437

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
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PN	US/MH Name	Surcharged		Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Volume (m ³)	Flow (l/s)						
1.000	1	-0.098	0.000	0.000	0.77				53.0	OK	
1.001	2	-0.082	0.000	0.000	0.87				57.7	OK	
1.002	3	-0.144	0.000	0.000	0.51				91.6	OK	
2.000	4	0.640	0.000	0.000	1.10			5	66.3	SURCHARGED	
2.001	5	0.627	0.000	0.000	1.15				72.6	SURCHARGED	
2.002	6	0.598	0.000	0.000	1.25				76.1	SURCHARGED	

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Micro Drainage

XP Solutions

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.003	7	15 Summer	30	+0%	30/15 Summer				164.350
1.004	8	15 Summer	30	+0%	30/15 Summer				164.092
1.005	9	15 Summer	30	+0%	30/15 Summer				163.783
1.006	10	15 Summer	30	+0%					163.340
3.000	11	360 Winter	30	+0%	100/240 Summer				160.401
3.001	12	360 Winter	30	+0%	100/120 Summer				160.399
1.007	13	360 Winter	30	+0%	100/60 Summer				160.396
1.008	14	360 Winter	30	+0%	100/60 Summer				160.368
1.009	15	360 Winter	30	+0%	100/60 Summer				160.351
4.000	16	360 Winter	30	+0%	100/120 Summer				160.344
4.001	17	360 Winter	30	+0%	100/60 Summer				160.344
4.002	18	360 Winter	30	+0%	100/60 Summer				160.344
1.010	19	360 Winter	30	+0%	100/30 Summer				160.344
5.000	20	360 Winter	30	+0%	100/60 Summer				160.329
1.011	21	360 Winter	30	+0%	100/30 Summer				160.329
1.012	22	360 Winter	30	+0%	100/30 Summer				160.306
1.013	23	480 Winter	30	+0%	2/15 Summer				160.278

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	7	0.581	0.000	1.71			241.8	SURCHARGED	
1.004	8	0.403	0.000	1.87			265.2	SURCHARGED	
1.005	9	0.177	0.000	2.62			265.3	SURCHARGED	
1.006	10	-0.240	0.000	0.42			304.3	OK	
3.000	11	-0.492	0.000	0.01			23.5	OK	
3.001	12	-0.323	0.000	0.00			9.6	OK	
1.007	13	-0.240	0.000	0.02			53.2	OK	
1.008	14	-0.175	0.000	0.02			44.2	OK	
1.009	15	-0.137	0.000	0.03			40.1	OK	
4.000	16	-0.415	0.000	0.00			8.0	OK	
4.001	17	-0.298	0.000	0.00			2.9	OK	
4.002	18	-0.181	0.000	0.00			4.4	OK	
1.010	19	-0.131	0.000	0.02			36.6	OK	
5.000	20	-0.218	0.000	0.00			8.7	OK	
1.011	21	-0.106	0.000	0.02			39.1	OK	
1.012	22	-0.061	0.000	0.02			40.0	OK	
1.013	23	1.267	0.000	0.18			16.7	SURCHARGED	

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RSK LDE		Page 15
14 Beecham Court Pemberton Business Park Wigan WN3 6PR		
Date 01/01/0001	Designed by LSteedman	
File SN1 - DETAILED DESIGN JU...	Checked by	
XP Solutions		Network 2020.1.3

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for SN1 JUN 25.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 401500 343900 SK 01500 43900
C (1km)	-0.028
D1 (1km)	0.388
D2 (1km)	0.309
D3 (1km)	0.349
E (1km)	0.302
F (1km)	2.337
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1 15	Summer	100	+40%	100/15	Summer			167.564
1.001	2 15	Summer	100	+40%	100/15	Summer			167.346
1.002	3 15	Summer	100	+40%	100/15	Summer			167.157
2.000	4 15	Summer	100	+40%	30/15	Summer			165.596
2.001	5 15	Summer	100	+40%	30/15	Summer			165.398
2.002	6 15	Summer	100	+40%	30/15	Summer			165.224

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