Table A1 identifies the review score information (as provided by Drain London Tier 1 consultant) for Table A2.

Table A – 1. Review Score Criteria

Data Quality Score	Description	Explanations	Example
1	Best possible	No better available; not possible to improve in the near future	High resolution LiDAR, River/sewer flow data, Rain gauge data
2	Data with known deficiencies	Best replaced as soon as new data are available	Typical sewer or river model that is a few years old
3	Gross assumptions	Not invented but based on experience and judgement	Location, extent and depth of much surface water flooding. Operation of un-modelled highway drainage 'future risk' inputs e.g. rainfall, population
4	Heroic assumptions	An educated guess	Ground roughness for 2D models
N/A			

Table A – 2. Data Review

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Defence_OCG4 &5.zip	PROTECT- COMMERCIAL. Location of Thames Tidal defences with condition grade 4 or 5 (shapefile)	Extract from NFCDD	2	Tidal Defences
Environment Agency	FailingAssets.zip	PROTECT COMMERCIAL. Thames Tidal defences with condition grade 4 or 5 (report from NFCDD)	Extract from NFCDD	2	Tidal Defences
Environment Agency	System Asset Management Plan Summary Reports.zip	PROTECT COMMERCIAL. System Asset Management Plan Summary Reports for South London, containing strategic drivers, major assets, failing assets and planned interventions.	Extract from NFCDD	2	Asset Management
Environment Agency	FRM_Systems_ NE.zip	PROTECT COMMERCIAL. System Asset Management Plan Summary Reports for North London, containing strategic drivers, major assets, failing assets and planned interventions.	Extract from NFCDD	2	Asset Management
Environment Agency	FRM_Systems_ SE.zip	System Asset Managament Plan Shapefile showing location of systems in London.	No known limitations	2	Asset Management
Environment Agency	Maintenance programmes for 2009-10.zip	Environment Agency maintenance programmes for 2009-2010 for London.	No known limitations	2	Maintenance
Environment Agency	Routine_maintenance_2010_2011_Web_version_June.xls	Environment Agency routine maintenance activities 2010-2010 for London.	No known limitations	2	Maintenance

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Other_Maintenance_activities_2010-11.xls	Environment Agency other (non-routine) maintenance activities 2010-2011 for London.	No known limitations	2	Maintenance
Environment Agency	catchment_50k.zip	Catchment area shapefile for Thames Region, attributed with catchment names and codes.			Catchment Area
Environment Agency	TE2100_Product Catalogue_V1_090924.xls	Excel spreadsheet of reports and data produced by Thames Estuary 2100 project. Not all reports and data are available for supply. Please get in touch with Tom Sampson at EA to enquire about reports or data which are relevant to Surface Water Management Plans in London.	Catalogue of reports provided. Not all reports and data are available for supply. Please get in touch with Tom Sampson at EA to enquire about reports or data which are relevant to Surface Water Management Plans in London.		Thames Estuary
Environment Agency	London_Discharges 04-10.xls	All discharge consents in London with grid reference.	No known limitations. Grid reference provided but not mapped.		Discharges
Environment Agency	LONDON_GQA 04-10.xls	2008 general quality assessments in London (not georeferenced)	File not georeferenced.	2	Water Quality
Environment Agency	London_WFD Status&Targets 04-10.xls	Water Framework Directive water quality status and targets (not spaitally referenced)	File incomplete. Should refer to Environment Agency website for up-to-date information.	3	Water Quality
Environment Agency	North_London_Fisheries Reports.zip	North London fisheries reports or studies	Nonly covers North London. No information provided for South London.	2	Water Quality
Environment Agency	Thames_CFMP_July_2008.zip	Thames Catchment Flood Management Plan (July 2008)	No known limitations.	2	Flood Management
Environment Agency	Thames_CFMP_Summary_Report_December_2009.pdf	Thames Catchment Flood Management Plan Summary Report (December 2009)	No known limitations.	2	Flood Management
Environment Agency	Thames_Region_CAMS.zip	Thames Region Catchment Abstraction Management Strategies	No known limitations.	2	Abstraction
Environment Agency	Thames_River_Basin_Management_Plan_2009.zip	Thames River Basin Management Plan (December 2009)	No known limitations.	2	Water Quality

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	flood_event_outline_10k_London.zip	Flood Event Outlines in London extracted from NFCDD. Only attribute fields approved for access have been supplied. Attributes: shapefile name - official NFCDD name (explanation) FLOODEVENT - Flood Event Code (unique code for flood event) FLOODEVE0 - Outline Code (unique code for each outline) FLOODEVE1 - Flood Event Name STARTDATE - Start Date ENDDATE - End Date SOURCEOFBO - Source of boundary (source of data) SOURCEOFFL - Source of flooding (e.g. main river) CAUSEOFFLO - Cause of flooding (e.g. overtopping of defences) FLIVIALFLA - Fluvial Ind (true/false if fluvial) TIDALFLAG - Tidal Ind (true/false if tidal) COASTALFLA - Coastal Ind (true/false if coastal) FLOODMAPIN - HFM Ind (flag indicating if outline is included on historic flood map)	No known limitations.	2	Historic Flooding
Environment Agency	Historic Flood Map OI193911.zip	Supplied through Geostore.Historic Flood Map Events is the maximum extent of all recorded individual Historic Flood Events Outlines from river, the sea and groundwater springs and shows areas of land that have previously been subject to flooding in England & Wales. The data is updated every three months, but may not change quarter to quarter if there have been no significant flood events in the preceding period. The dataset consists of spatial data only.Please note that this map shows flooding to the land and does not necessarily indicate that properties within the Historic Flood Map were flooded internally. It is also possible that the pattern of flooding in this area has changed and that this area would now flood under different circumstances. In addition, abscence of coverage by the Historic Flood Map for an area does not mean that the area has never flooded, only that we do not currently have records of flooding in this area.	No known limitations.	2	Historic Flooding

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Flood Map OI193910.zip	Supplied through Geostore. The Flood Map shows the areas across England and Wales that could be affected by flooding from rivers or the sea. It also shows flood defences and the areas that benefit from them. Flood Map is designed to raise awareness among the public, local authorities and other organisations of the likelihood of flooding, and to encourage people living and working in areas prone to flooding to find our more and take appropriate action. The Flood Map includes the following layers of information: Flood Zone 3 is the Agency's best estimate of the areas of land with a 100 to 1 (or greater) chance of flooding each year from rivers, or with a 200 to 1 chance (or greater) of flooding each year from the sea. Flood Zone 2 is the Agency's best estimate of the areas of land between Zone 3 and the extent of the flood from rivers or the sea with a 1000 to 1 chance of flooding in any year. It includes those areas defined in flood zone 3. Flood Defences shows those defences constructed during the last five years with a standard of protection equal to or better than 1 percent for rivers and 0.5 percent from the sea. (Some additional defences area also shown.) Areas Benefiting from Flood Defences shows those areas that would benefit from the presence of defences in a 1 percent fluvial / 0.5 percent tidal flood event. Flood Storage Areas shows those areas that act as a balancing reservoir, storage basin or balancing pond. Their purpose is to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel. It may also delay the timing of a flood peak so that its volume is discharged over a longer time interval.	No known limitations.	2	Flood Management and Planning
Environment Agency	Main River 10k OI183819.zip	Supplied through geostore. Main river centrelines showing which river sections are classified as main as approved by the Secretary of State.	No known limitations.	2	Flood Management and Planning
Environment Agency	Areas Susceptible to Surface Water Flooding OI170589.zip	Supplied through geostore.Flood data for areas naturally vulnerable to surface water flooding from a 1 in 200 year return period, 6.25 hour duration rainfall event over a 5 x 5km area.	No known limitations.	2	Flood Management and Planning
Environment Agency	Detailed River Network OI183820.zip	Supplied through geostore. The Detailed River Network (DRN) is the only large-scale, accurate and fully attributed digital river centreline covering England and Wales. The DRN is captured from the water features theme of the OS MasterMap topographic layer and built into a network using automated rules. Other input datasets and extensive local Environment Agency staff knowledge has been used to augment the core geometry to incorporate critical spatial detail and attribution, such as flow direction and path, not available from the OS mapping and to verify the accuracy of the centreline itself. The dataset has full-feature network geometry cross-referenced with OS MasterMap following Digital National Framework principles.	No known limitations.	2	Flood Management and Planning

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	NaFRA2008.zip	Supplied through geostore. NaFRA 2006 Spatial Flood Likelihood Category (FLC) Grid (version 8.2) is the latest output using the Risk Assessment for flood and coastal defence for Strategic Planning (RASP) High Level Method Plus (HLM+). It is a broad-brush assessment of the likelihood of flooding at a national scale, based on assessments undertaken for 85 river catchments and coastal cells, where a cell is an area of land measuring 50m by 50m. NaFRA 2008 Spatial (FLC) Grid enables a comparison of the relative risks and their distribution within each of these catchments, rather than a detailed, local assessment of the risk at a specific location. The calculations provide an indication of the likelihood of flooding at the centre of each cell. These results are then placed into three risk categories as used by the insurance industry. The three risk categories are: - low - the chance of flooding each year is 0.5 per cent (1 in 200) or less - moderate - the chance of flooding in any year is 1.3 per cent (1 in 75) or less but greater than 0.5 per cent (1 in 200) - significant - the chance of flooding in any year is greater than 1.3 per cent (1 in 75)	No known limitations.	2	Flood Management and Planning
Environment Agency	Readme.txt	Information related to downloaded Geostore data and licence issues. Environment Agency data supplied to Scott Wilson for use on behalf of the Greater London Authority, 7th May 2010 and 13th July 2010.	No known limitations. Only pertains to licensing/downloaded data.	1	Flood Management and Planning
Environment Agency	Model coverage_SE Thames_2010_28Apr10.zip	Shapefile of model availability in the Environment Agency, Thames South East Area.	No known limitations.	2	Flood Management and Planning
Environment Agency	Detailed Mapping Progress_Apr10.xls	Spreadsheet of detailed mapping progress and planned updates in Thames South East Area	No known limitations.	2	Flood Management and Planning
Environment Agency	Beverley Brook Product 5 Model Report.zip	Fluvial flood model. Beverley Brook Product 5 - model reports. Final Report_Beverley Brook_09 06 09	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Beverley Brook Product 6 Model Output Data.zip	Fluvial flood model. Beverley Brook Product 6 - model output data. Contains: ISIS & Tuflow results files, flood extents and report with model outputs.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Beverley Brook Product 7 CaVMID.zip	Fluvial flood model. Beverley Brook Product 7 - CaVMID (Calibrated & Verified Model Input Data). Contains ISIS-Tuflow model input files including hydrological inflows.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill IUD Product 5 Model Report.zip	Surface water modelling and planning. Hogsmill IUD Product 5 - model reports. Includes: Hogsmill Pilot IUD - Final Report_Vol 1_170608, Hogsmill IUD Pilot Vol 2_170608, Hogsmill IUD Final_Vo1 3, Hogsmill IUD Exe Summary_18.06.08	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Hogsmill IUD Product 7 CaVMID.zip	Surface water Infoworks model files. Hogsmill IUD Product 7 - CaVMID (Calibrated & Verified Model Input Data). Contains: Hogsmill Final 2D Models Infoworks	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 1 2003 Product 5 Reports.zip	Fluvial flood model. Hogsmill Phase 1 Product 5 - model reports. Final Hydrology Report, Final Hydraulic report	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 1 2003 Product 6 Model Outputs.zip	Fluvial flood model. Hogsmill Phase 1 Product 6 - model output data. Contains: flood outlines, ISIS results, Flow & level spreadsheet, ArcGIS shapefiles	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 1 2003 Product 7 CaVMID.zip	Fluvial flood model. Hogsmill Phase 1 Product 7 - CaVMID (Calibrated & Verified Model Input Data). Contains ISIS model input files including hydrological inflows.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 2 Product 5 Reports.zip	Fluvial flood model. Hogsmill Phase 2 Product 5 - model reports. TH662_Hogsmill_Hydraulic_Report	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 2 Product 6 Model outputs.zip	Fluvial flood model. Hogsmill Phase 2 Product 6 - model output data. Contains: flood outlines, ISIS & tuflow results, Flow & level spreadsheet, ArcGIS shapefiles	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Hogsmill Phase 2 Product 7 CaVMID.zip	Fluvial flood model. Hogsmill Phase 2 Product 7 - CaVMID (Calibrated & Verified Model Input Data). Contains ISIS-Tuflow model input files including hydrological inflows.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Ravensbourne Product 5 Reports.zip	Fluvial flood model. Ravensbourne 2009 Product 5 - model reports. Contains: Ravensbourne Model Review, Response to Ravensbourne Model Review, Ravensbourne Culvert Survey Report, Ravensbourne 2D Modelling 2009, Ravensbourne Hazard Mapping Report.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Ravensbourne Product 6 Model Outputs.zip	Fluvial flood model. Ravensbourne 2009 Product 6 - model output data. Contains: flood outlines, ISIS & tuflow results, Flow & level spreadsheet, ArcGIS shapefiles, Hazard maps,	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Ravensbourne Product 7 CaVMID.zip	Fluvial flood model. Ravensbourne 2009 Product 7 - CaVMID (Calibrated & Verified Model Input Data). Contains ISIS-Tuflow model input files including hydrological inflows.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Ravensbourne Delivery Plan Product 5 reports.zip	Surface water flood model. Ravensbourne Delivery Plan (2009). Product 5 - reports. Contains: Ravensbourne Delivery Plan April 2009 V13, Ravensbourne Delivery Plan Maps April 2009.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Ravensbourne Delivery Plan Product 6 Model Outputs.zip	Surface water flood model. Ravensbourne Delivery Plan (2009). Product 6 - model outputs . Contains: tuflow output files	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Beam,Ingrebourne and Marshes East Model 2006.zip	Beam, Ingrebourne & Marshes East Model (Jacobs, 2006) GIS - Modelled outlines, nodes, reservoir units Model - .dat files, .ixy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Beam,Ingrebourne and Marshes West Model 2006.zip	Beam, Ingrebourne & Marshes West Model (Halcrow, 2006) GIS - Modelled outlines, nodes, reservoir units Model - .ief files, .gxy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	River Brent Modelling and Mapping Study 2009.zip	River Brent Modelling & Mapping Study (Jacobs, 2009) GIS - modelled outlines, nodes Model - .ied files, .gxy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	River Crane Modelling and Mapping Study 2008.zip	Provided in: North London Flood Model Products 5, 6 & 7 River Crane Modelling & Mapping Study (Halcrow, 2008) GIS - modelled outlines, nodes Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Lower Colne Improvement Scheme Modelling 2004.zip	Lower Colne Improvement Scheme Modelling (PBA, 2004) GIS - modelled outlines, nodes, reservoir units Model - .ied, .dat and .ixy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	River Pinn Flood Mapping Study 2008.zip	River Pinn Mapping Study (Mott MacDonald, 2008) GIS - modelled outlines, nodes, ABDs Model - .dat, .feb, .gxy, .ief, .zzd, .zzl Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Beam,Ingrebourne and Marshes (West) Mayes Brook Model 2006.zip	Beam, Ingrebourne & Marshes (West) - Mayes Brook (Halcrow, 2006) GIS - Modelled outlines, nodes, reservoir unitsModel - .dat, .ied, .feb, .gxy	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Lower Roding Strategy Modelling 2005.zip	Lower Roding Strategy Model (B&V, 2005) GIS - Modelled outlines, nodes, reservoir units Model - .dat, .ied, .feb, .gxy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Middle Roding Section 105 Modelling 2003.zip	Middle Roding Section 105 model (Jacobs, 2003) GIS - Modelled outlines, nodes, reservoir units Model - .dat, .ied, .feb, .gxy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	Newham SFRA.zip	Newham SFRA modelling (Capita Symonds, 2010) Inflows (excel)	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Silk Stream FAS Modelling 2007.zip	Silk Stream FAS modelling (Halcrow, 2007) GIS - Modelled outlines, nodes Model - .dat	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Upper Colne Strategy Modelling 2004.zip	Upper Colne Strategy Modelling (Halcrow, 2004) GIS - Modelled outlines, nodes, reservoir units Model - .dat, .gxy Reports + appendices	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Erith Product 5 Reports.zip	Integrated flood risk model. Erith Marshes Ditches & Dykes study. Product 5 - model reports. Contains: Erith Marshes Ditches and Dykes Study Surface Water Management Final Report, Erith Marshes Ditches and Dykes Hydrology Phase 2	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Erith Product 6&7 Model files.zip	Integrated flood risk model. Erith Marshes Ditches & Dykes study. Product 6&7 - infoworks model files of baseline and scenario tests.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Thamesmead Product 5 Reports.zip	Integrated flood risk model. Thamesmead canals masterplan evidence base. Product 5 - model reports. Contains: Thamesmead Canal Corridor Enhancement Masterplan, 26621 C025 Thamesmead Canal Corridor DRAFT Model Report v1.0, 26621-C021 - WQ Report Chapter v4 - FINAL DRAFT 9Apr10, 26621-C022 Thamesmead_ECOLOGY_12Apr10, 26621-C024 - CL Report Chapter	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Thamesmead Product 6&7 model files.zip	Integrated flood risk model. Thamesmead canals masterplan evidence base. Product 6&7 - infoworks model files of baseline and scenario tests.	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Lee Detailed Model.zip	River Lee detailed model. Contains GIS modelled outlines and nodes	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Wandle Product 5.zip	Fluvial model Wandle Product 5 - model reports	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	Wandle Product 6	Fluvial model Wandle Product 6 - model output data	No known limitations but must be aware input data and modelling assumptions used in generating models.	2	Flood Management and Planning
Environment Agency	NE_Flowdata_Apr10.xls	River flow data from 2004 to 2010 in North London	No known limitations.	2	River Flow

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	NE_Groundwaterdata_Apr10.xls	Groundwater level data from 2004 to 2010 in North London	No known limitations.	2	Groundwater Level
Environment Agency	NE_Rainfalldata_Apr10.xls	Rainfall data from 2000 to 2010 in North London	No known limitations.	2	Rainfall
Environment Agency	EA_Hydrometric_data_network_London.zip	Shapefile of hydrometric data network in London including river, rain and groundwater monitoring locations.	No known limitations.	2	Monitoring Locations
Environment Agency	SE_Flowdata_May10.xls	River flow data from 2004 to 2010 in South London	No known limitations.	2	River Flow
Environment Agency	SE_Wandle_GW.xls	Groundwater level data from 2004 to 2010 in the Wandle catchment South London	No known limitations.	2	Groundwater Level
Environment Agency	SE_Ravensbourne_GW.xls	Groundwater level data from 2004 to 2010 in the Ravensbourne catchment South London	No known limitations.	2	Groundwater Level
Environment Agency	SE_Hogsmill_GW.xls	Groundwater level data from 2004 to 2010 in the Hogsmill catchment South London	No known limitations.	2	Groundwater Level
Environment Agency	SE_Thamesmead_GW.xls	Groundwater level data from 2004 to 2010 in the Thamesmead catchment South London	No known limitations.	2	Groundwater Level
Environment Agency	SE_Beverley_Brook_GW.xls	Groundwater level data from 2004 to 2010 in the Beverley Brook catchment South London	No known limitations.	2	Groundwater Level
Environment Agency	SE_Rainfall_May10.xls	Rainfall data from 2000 to 2010 in South London	No known limitations.	2	Rainfall
Environment Agency	NE_Thames_Drift_Geology_GW Vulnerability_map.pdf	North London drift geology groundwater vulnerability map	No known limitations.	2	Groundwater Vulnerability
Environment Agency	NE_Thames_GW_Nitrate_Vulnerability_Map.pdf	North London groundwater nitrate vulnerability map	No known limitations.	2	Groundwater Nitrate Vulnerability
Environment Agency	NE_Thames_Solid_Geology_GWVulnerability_map.pdf	North London solid geology groundwater vulnerability map	No known limitations.	2	Groundwater Vulnerability
Environment Agency	LondonRainfall.zip	Rainfall data from all relevant rainagauges in London	No known limitations.	1	Rainfall data
Environment Agency	FWAs_NE_March_2010.zip	Flood Warning Areas in North London	No known limitations.	2	Flood Management and Planning
Environment Agency	FWAs_SE_March_2010.zip	Flood Warning Areas in South London	No known limitations.	2	Flood Management and Planning

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Environment Agency	EAGEOSTORE_OI204652.zip	The National Receptor Dataset (NRD) is a collection of risk receptors primarily intended for use in flood and coastal erosion risk management. It is available for use by Local Planning Authorities, Environment Agency and their contractors. NRD is a spatial dataset which contains a number of GIS layers categorised into themes of information including buildings, environment, heritage, transport, utilities. These are defined in more detail in this document. Coverage is provided for England and Wales (where available) only. The data stored within the NRD meets the information requirements of a range of Flood and Coastal Risk Management (FCRM) practitioners within the Local Planning Authorities and Environment Agency. This first version of the dataset has been designed to meet the needs of Preliminary Flood Risk Assessments and the Environment Agency's National Flood Risk Assessment.	No known limitations.		Flood and Coastal Risk Management, buildings, environment, heritage, transport, utilities
Thames Water	TWL_1A_NoData.txt	This data is not readily available and would be difficult to create. TW would be concerned about how this data could be interpreted if it were created.	N/A	N/A	TW Sewer Network Model
Thames Water	Pipes_33_LA.zip	GIS layer provided on CD. Contains details of the sewer network, both foul and surface water for all 33 London boroughs (location and pipe heights).	Unsure how the network is updated/maintained but this is the best information currently available.	1	TW Sewer Network Model
Thames Water	Pumping_Station_1_33_LA.zip	GIS layer provided on CD. Contains details of the pumping station name, location, area, owner etc	Unsure how the network is updated/maintained but this is the best information currently available.	1	Pumping stations
Thames Water	Pumping_Station_2_33_LA.zip	GIS layer provided on CD. Contains details of the pumping station name, location, area, owner etc	Unsure how the network is updated/maintained but this is the best information currently available.	1	Pumping stations
Thames Water	Manhole_33_LA.zip	GIS layer of manhole locations (xref) purpose, some cover and invert levels where available	Unsure how the network is updated/maintained but this is the best information currently available.	1	manhole locations
Thames Water	CSO_locations_33_LA.zip	GIS layer of CSOs, location, receiving watercourse name, discharge type etc	Unsure how the network is updated/maintained but this is the best information currently available.	1	CSO overflow locations
Thames Water	TWL_1F_NoData.txt	This data is not specifically highlighted but is on the network plans - users will have to manually identify.	N/A	N/A	sewer outfalls
Thames Water	STW_locations_33_LA.zip	GIS layer of Sewage Treatment Work locations.	Best information available.	1	sewerage storage
Thames Water	TWL_1GNoData.txt	This is part of the sewer network GIS. Where storage systems are above ground (legacy systems) they will be visible on maps. Deep tank sewers are not always highligted but can be identified on the sewer network GIS (user will have to trace along the network to find increases in pipe sizes). Deep shafts are not all mapped.	N/A	N/A	sewerage storage

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Thames Water	TWL_1H_NoData.txt	These are not seperated out on the network - may be able to find them in the sewer network if you know where they are. TW have the responsibility for some watercourses where they should not have as they should be the responsibility of the LA. TW are keen to see as an output of the SWMP, a resolution of assets and culvert ownership.	N/A	N/A	culvert location
Thames Water	TWL_1I_NoData.txt	This data is not readily available as some are mapped and some are not. The network ops team will have this information but there are 3x west teams, 2x central teams and 1x east team.	N/A	N/A	hydrobrake flow control
Thames Water	TWL_1J_NoData.txt	There is no specific information on SUDS schemes within London (there are about 350 SuDS assetts across Thames Region that TW have adopted). Where SuDS are located on-line, there is a question over who is responsible for them. On the GIS sewer network a SuDS scheme is identified by a gap in the network - this should be cross referenced with aerial photography and council information. Some SuDS are let to local councils who then are responsible for maintenance.	N/A	N/A	sustainable drainage systems SUDS
Thames Water	TWL_2A_NoData.txt	Not available at this time - TW will supply extracts of the model for specific CDAs if required by consultants as part of the SMWP studies	The infoworks model will be very large to transfer for the whole of London	N/A	TW Sewer Network Model
Thames Water	TWL_2B_NoData.txt	Not available at this time - TW will supply extracts of the model for specific CDAs if required by consultants as part of the SMWP studies	N/A	N/A	TW Sewer Network Model
Thames Water	TWL_2C_NoData.txt	There is a lot of data (boxes of CDs). If CCTV survey is required in specific CDAs - TW will supply if available (the survey supporting reports may be more useful than the actual survey)	N/A	N/A	CCTV survey
Thames Water	TWL_3A_NoData.txt	This information is based on a 4-figure post code. No greater level of detail can be provided as it is protected by the data protection act. The request for this information will have to come from the Las. TW noted that in areas where flooding may be an issue, there could be opportunities for LA to work with TW to reduce the catchment size outfalling to a particular location/problem sewer.	N/A	N/A	DG5 sewer flooding
Thames Water	TWL_3B_NoData.txt	TW were unsure if this would be of any use as would be more important on smaller diameter sewers. TW looking into provision of this data.	N/A	N/A	sewer blockage
Thames Water	TWL_3C_NoData.txt	TW only have reports in delivering solutions in areas where flooding occurs. These reports will hold info about previous flooding at specific areas. TW to look into provision of this data.	N/A	N/A	flood events records
Thames Water	TWL_4A_NoData.txt	These are high level reports which will outline where problem areas are located. They are currently being created as part of the AMP 5/6 process. TW to find out timescales for this, however, it should be noted that the drainage area plans will be made up of the information provided above.	N/A	N/A	Drainage Area Plans
Thames Water	TWL_4B_NoData.txt	All assets should be at the required standard - this data is limited.	N/A	N/A	Drainage asset condition records
Thames Water	TWL_4C_NoData.txt	There is a great deal of data which would take a long time to collate for the whole of london. TW to be contacted directly for specific maintenance records in CDAs if required.	N/A	N/A	Drainage maintenance records
Thames Water	TWL_4D_NoData.txt	see above	N/A	N/A	Infrastructure condition/performance data

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Thames Water	hogsmill IUD.zip	IUD for Brent and Hogsmill have been downloaded from the internet	These reports were written in 2008, guidance may have been superceded	2	Integrated Urban Drainage studies
Thames Water	TWL_4G_NoData.txt	As part of AMP5 TW are looking at increasing their understanding of the system. As part of AMP6 TW are looking to produce additional detailed network modelling.		N/A	AMP investments linked to surface water
British Waterways	Water Control Manual_London v 1.3.pdf	Water Control Manual for London v1.3	Continually Updated. Next update due November 2010.	1	Canal, Maintenance, Control
British Waterways	BW_Canals_Within_London_Boroughs.zip	GIS shapefile of British Waterways Canals in London	GIS layer of Britsh Waterways Canal Network in Greater London administrative area.	1	Canal
British Waterways	Anecdotal Flood Records 20100622.doc	Anecdotal Flooding Records	Summary of anecdotal flood records, or other notable details.	1	Canal flooding, overtopping
British Geological Survey	DiGMapGB-50 V5.18.zip	DiGMapGB-50 V5.18 GIS Layers (1:50k)	Best data available	2	Geology Mapping
British Geological Survey	Parent Materials.zip	Soil Parent Material Model GIS Layer	Best data available	2	Soil
British Geological Survey	Permeability V5.zip	Permeability V5 GIS Layer	Best data available	2	Permeability
British Geological Survey	Susceptibility to Groundwater Flooding.zip	Susceptibility to Groundwater Flooding GIS Layer	Best data available	2	Groundwater Flooding
British Geological Survey	Geologcal Indicators of Flooding V5.1.zip	Geological indicators of flooding GIS layer	Best data available	2	Groundwater Flooding
Greater London Authority	London_Assembly_constituency.zip	GIS Shapefile of London Assembly Constituency	No known limitations	1	Boundaries
Greater London Authority	London_Borough.zip	GIS Shapefile London Boroughs	No known limitations	1	Boundaries
Greater London Authority	London_Borough_Excluding_MHW.zip	GIS Shapefile of London Boroughs with River Thames boundary mapped.	No known limitations	1	Boundaries
Greater London Authority	London_GLA_Boundary.zip	GIS Shapefile of London GLA Boundary	No known limitations	1	Boundaries

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Greater London Authority	London_GLA_Boundary_within_England.zip	GIS Shapefile of London GLA Boundary within England	No known limitations	1	Boundaries
Greater London Authority	London_Inner_Boundary.zip	GIS Shapefile of London Inner Boundary	No known limitations	1	Boundaries
Greater London Authority	london_subregions_2006.zip	GIS Shapefile of London Subregions 2006	No known limitations	1	Boundaries
Greater London Authority	London_Ward.zip	GIS Shapefile of London Ward	No known limitations	1	Boundaries
Greater London Authority	London_Ward_CityMerged.zip	GIS Shapefile of London Ward City Merged	No known limitations	1	Boundaries
Greater London Authority	London_Westminster_Constituency.zip	GIS Shapefile of London Westminster Constituency	No known limitations	1	Boundaries
Greater London Authority	Areas for Regeneration LP 2009.zip	GIS MapInfo file of London Plan 2009 Areas for Regeneration	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	Areas_for_Intensification_PointData_LP2009.zip	GIS MapInfo file of London Plan 2009 Areas for Intensification	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	blueribbon network.zip	GIS Shapefile of London Plan 2009 Blueribbon Network	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	CAZ_Boundary_LP2009.zip	GIS MapInfo file of London Plan 2009 Central Activities Zone Boundary	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	Inner_Outer_London_Boundaries_LP2009.zip	GIS MapInfo file of London Plan 2009 Inner Outer London Boundaries	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	Opportunity_Area_PointData_LP2009.zip	GIS MapInfo file of London Plan 2009 Opportunity Area	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	SILs_pointdata_Sep09.zip	GIS MapInfo file of London Plan 2009 Strategic Industrial Locations (September 2009)	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	Subregions_LP2009.zip	GIS MapInfo file of London Plan 2009 Subregions	Based on London Plan 2009.	2	London Plan 2009
Greater London Authority	mastermap.zip	OS Mastermap Layers in ESRI Shapefile and MapInfo format	No known limitations	1	OS Mapping
Greater London Authority	OS10k.zip	OS 1:10k Layers in ESRI Shapefile and MapInfo format	No known limitations	1	OS Mapping
Greater London Authority	OS50k.zip	OS 1:50k Layers in ESRI Shapefile and MapInfo format	No known limitations	1	OS Mapping
Greater London Authority	VirtualLondonLidar.zip	Virtua London Lidar Imagery in ESRI Shapefile and MapInfo format	Imagery only.	2	Imagery

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Greater London Authority	GISDataCatalogue.xls	Catalogue of GIS holdings for GLA	No known limitations but will be updated regually so may need to check for updated version	2	Data Catalogue
London Fire Brigade	flooddata.csv	Spreadsheet containing all records of flooding shouts since 2000	Best available data	2	Flooding records
London Fire Brigade	Flooding photos.zip	Zip folder containing photos of flood incidents	Best available data		Flooding records
London Fire Brigade	Flood Incident Photos.doc	Word document describing photos	Best available data		Flooding records
London Fire Brigade	LFB Maps.zip	PDF maps showing frequency of calls due to flooding in London. Created using the data set provided to us in excel spreadsheet	Best available data		Flooding records
London Underground	LUG_1A_NoData.txt	Not available	N/A	N/A	LU assets
London Underground	LUG_1B_NoData.txt	Not available	N/A	N/A	surface water flood risk assets
London Underground	Manager's review report.doc	Provided two files containing records of flooding incidents of both the tracks and stations in July 2007	Anecdotal data	2	historic records of flooding
London Underground	Flood risk.xls	Provided two files containing records of flooding incidents of both the tracks and stations in July 2007	Anecdotal data	2	historic records of flooding
London Underground	Paddington Train Stranded.jpg	Photograph showing train stranded at Paddington Train.	Anecdotal data	2	historic records of flooding
London Underground	LUG_1D_NoData.txt	Not available	N/A	N/A	Operating Incidents
London Underground	Copy of Pump Site Data for GLA.xls	excel spreadsheet detailing pumping regime provided	No known limitations	2	LU pumping surface water
London Underground	LUG_1F_NoData.txt	No recorded data	N/A	N/A	flood mitigation measures
London Underground	LUG_1G_NoData.txt	No recorded data	N/A	N/A	station flood resilience plans
Network Rail	540889_IMDM_CoreEK_18082009.pdf	Maps taken from the main Network Rail database. No external consultant has access and so no shape files are available	Best data available	2	Railway Flooding
Network Rail	540888_Routes_CoreEK_17102008.pdf	Maps taken from the main Network Rail database. No external consultant has access and so no shape files are available	Best data available	2	Railway Flooding
Network Rail	nationalrailnetworkmap.pdf	Map taken from Network rail website, showing whole rail network	Best data available	2	Railway Flooding

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Network Rail	Flood incident summary_SPC_ ECM1_HDB Routes.doc	Document outlines overall drainage/Flooding issues on sections of the line.	Best data available	2	Railway Flooding
Network Rail	New Southgate site visit 7thJan09.doc	Site report on Southgate flooding incident	Best data available	2	Railway Flooding
Network Rail	Potters Bar site visit .doc	Site report on potters bar flooding incident	Best data available	2	Railway Flooding
Network Rail	New Southgate site visit of 4th May 10.doc	Site report on second Southgate flood incident	Best data available	2	Railway Flooding
Network Rail	ECM1 5.0000 Alexander Palace.zip	Photos of flooding at Alexander Palace station	Best data available	2	Railway Flooding
Network Rail	SPC1 12.0076 12.0559 Drain Up Elstree Tunnel 20080606 V4.doc	Site report of flooding at Elstree tunnel	Best data available	2	Railway Flooding
Network Rail	MCJ1 - Drainage Survey.zip	Drainage survey for the MCJ1 line	Best data available	2	Railway Flooding
Network Rail	10Chain_Diagram_Key.pdf	PDF showing the diagram key for the drainage surveys	Best data available	2	Railway Flooding
Network Rail	Flood incident summary_MCJ1 Route.doc	Word document describing flooding problems in the last 5 years on the MCJ1 line	Best data available	2	Railway Flooding
Network Rail	Flood Sites _LNW Route.xls	Excel spreadsheet give details of flooding on the LNW route	Best data available	2	Railway Flooding
Network Rail	Areas Prone To Flooding Within M25 - SE Routes.xls	Excel spreadsheet listing details of lines prone to flooding with territory	Best data available	2	Railway Flooding
Network Rail	Network Rail SE Routes.pdf	PDF map showing SE route	Best data available	2	Railway Flooding
Network Rail	Park Hill Park, Croydon.zip	Zip folder containing photos of landslide caused by surface water at Park Hill	Best data available	2	Railway Flooding
Network Rail	2007-07-20 - Fulwell to Hampton after summer storm.zip	Zip folder containing photos of flooding on the Fulwell to Hampton line during 2007 flooding.	Best data available	2	Railway Flooding

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Network Rail	Flood incident summary_S_SE territory.doc	Document listing all data sets provided and brief description of some of them.	Best data available	2	Railway Flooding
Network Rail	NET_1E_NoData.txt	No data provided. But covers the line coming out of Paddington Station	No data available		Railway Flooding
Network Rail	NET_1F_NoData.txt	In the long term by May 2011 each borough will have information pack following completion of national drainage survey	No data available		Rail Network
Transport for London	Pump stations.zip	Location of seven (7) pump stations in central London including: Eastway Tunnel Pump House, Blackfriars Underpass, Glencoe Street Pump House, Bow Road Pump House, Old Fort Road Pump House, Redpath Pump House, York Road/Trinity Road Pump Station. Layout of nine (9) pump stations in south London, including: New Malden, Purley Cross, Crittalls Corner, South Lane, Bushey Road, Cambridge Ave, Keswick Ave, Warren Drive, Deer Park. Layout of nineteen (19) pump stations in north London	It is assumed that TFL have send the most up to date and accurate data that is currently available.	1	TFL pump station locations and details
Transport for London	TFL Gullies Pan London with Northings and Eastings.xls	Spreadsheet with the location, asset type, assed id, borough name, x and y of gulleys	It is assumed that TFL have send the most up to date and accurate data that is currently available.	1	tfl gulley location spreadsheet and details
Transport for London	TFL_1B_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Transport for London	TLRN.zip	Transport for London Road Network provided	It is assumed that TFL have send the most up to date and accurate data that is currently available.	1	TFL road network
Transport for London	TFL_1D_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Transport for London	TFL_1E_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Transport for London	TFL_1F_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Transport for London	TFL_1G_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Transport for London	TFL_1H_NoData.txt	Data not received from TFL	N/A	N/A	N/A
Highways Agency	Draft IAN HADDMS data population March 2008.pdf	Asset inventory data guidance document (draft, March 2008).	Best data available	2	Drainage Assets
Highways Agency	Asset_Inventory_GIS_Data.zip	Asset inventory data as ESRI Shapefiles.	Best data available	2	Drainage Assets
Highways Agency	HWA_1B_NoData.txt	Included within the asset inventory where they are present - See Item 1A.	N/A	N/A	Drainage Assets
Highways Agency	HWA_1C_NoData.txt	Included within the asset inventory where they are present - See Item 1A.	N/A	N/A	Critical Assets

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Highways Agency	HWA_1D_NoData.txt	The Highways Agency has established a national flood register to collate flooding incident records from all sources, not just call centres. This is new and is currently poorly populated. There is no data for the Greater London Area.	N/A	N/A	Flooding Records
Highways Agency	Flooding_Hotspot_Area5.zip	A flood risk assessment has recently been carried out and a map extract has been provided as ESRI Shapefile.	Best data available	2	Susceptible Assets
Highways Agency	HWA_1F_NoData.txt	The Highways Agency has established a national flood register to collate flooding incident records from all sources, not just call centres. This is new and is currently poorly populated. There is no data for the Greater London Area.	N/A	N/A	Flooding Records
Highways Agency	HWA_1G_NoData.txt	Specific records of the designed capacity for each item of HA drainage are not available. The HA's design guidance is consolidated in HD33/06 which is available from http://www.standardsforhighways.co.uk/dmrb/vol4/section2.htm	N/A	N/A	Drainage Assets
Highways Agency	HA Drainage and Flood Data Description rev 03 2010_07_16.pdf	Description of the flood and drainage data provided by the Highways Agency for the Drain London project.	For information.	1	Data Information
Natural England	tqawitab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Ancient Woodland
Natural England	tqeshtab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Environmental Stewardship
Natural England	tqnnrtab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	National Nature Reserves
Natural England	tqramtab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	RAMSAR Sites
Natural England	tqssstab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Sites of Special Scientific Interest

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Natural England	tqsactab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Special Areas of Conservation
Natural England	tqspatab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Special Protection Areas
Natural England	tqsittab.zip	For TQ Tile	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	SSSI Unit
Natural England	ellnrtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Local Nature Reserves
Natural England	emcpktab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Country Parks
Natural England	mgaontab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Areas of Outstanding Natural Beauty
Natural England	ebmgrtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Millennium Green
Natural England	bpcgmtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Coastal floodplain grazing marsh
Natural England	bpldatab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Lowland dry acidic grassland

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
Natural England	bplhltab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Lowland heath
Natural England	bpdwdtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Deciduous Woodland
Natural England	bpmudtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Mudflat
Natural England	egndwtab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Deciduous woodland networks
Natural England	egngstab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Grassland Networks
Natural England	egnhttab.zip	England Wide	Best available at the time downloaded. May be updated periodically so read docs in folder and check web site for updates	1	Heathland Networks
London City Airport	No_Data	No data provided as according to correspondence the airport does not have flooding problems. External consultants are Atkins and their main contact is Rob Jenna.	No data available		Airport flooding
LB of Newham	NEW_1A_NoData.txt	Flood data isn't currently recorded centrally. This is something that is being looked in to including a standard flood incident report form, which Borough would ask all council departments to use/complete. Flooding in Stratford Shopping Mall about 10 years ago. Olympic Development site. EA produced SFRA. Will reduce flood risk in area – check with EA.	N/A	N/A	Surface Water Flooding
LB of Newham	NEW_1B_NoData.txt	No information held centrally. No known major incidents.	N/A	N/A	Flood Records July 2007

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
LB of Newham	NEW_1C_NoData.txt	Highways team is responsible for the cleaning out and maintenance of privately owned gullies and sewers. They have been keeping paper files for the last 4 years. No records beyond this. They log each incident on a job sheet with a rough sketch. The paper files (now several hundred) are held at The Lodge on Cemetery Road. It suggested it might be worth searching for the original architects' drawings.	N/A	N/A	Highways flooding drainage
LB of Newham	Bid 1.zip	North Woolwich Town Bid 1 for Early Action Funding. Includes maps and photgraphs. Area is very low lying (and not permeable with high water table) and known drainage issues in area. Outfall to Thames is blocked and owner of surface water pipe has not been identified. Contains photographs. King George V DLR to the Thames. As outfall blocked water backing up into streets. Chapel Field Sewer. Backs up every time there is heavy rain and high tides. Water up to doorsteps but no flooding as yet. Some flooding reported by residents but verbal records – no written documents. Need to look at entire drainage system in North Woolwich area. 1m diameter. Just surface water. Need to identify owner. Several Victorian properties with cellars/basements that keep flooding in Borough.	No known limitations.	2	Flooding Hotspot
LB of Newham	Bid 2.zip	North Woolwich Town Bid 2 for Early Action Funding. Includes maps and photgraphs	No known limitations.	2	Flooding Hotspot
LB of Newham	NEW_1D_NoData.txt	On-going surface water flooding problem on Arragon Road, E6 for about 10 years. At its worst, water 6 ½ inches deep and flooding residential properties. On-going dispute between Council and Thames Water means problem continues. See e-mail from John McDermott for more information. Consult Tony Osborne or Lisa Wild for more recent information	N/A	N/A	Flooding Hotspot
LB of Newham	NEW_1E_NoData.txt	Sarah Diamond who works for Newham Homes has confirmed that two blocks of council managed flats in the borough have been flooded as a result of surface water drainage problems on the roof. I'm waiting for further details but she reported no other flood incidents affected council managed properties.	N/A	N/A	Flooding Anecdotal
LB of Newham	NEW_2A_NoData.txt	Not held by GIS team	N/A	N/A	Planned Development
LB of Newham	NEW_2B_NoData.txt	Available but not provided	N/A	N/A	Open Spaces
LB of Newham	NEW_2C_NoData.txt	Point layers locating the positions of hospitals etc Transport - points locating stations and a road network (3rd Party) available but not provided	N/A	N/A	Critical Assets
LB of Newham	NEW_2D_NoData.txt	None that GIS Team are aware of. There may be some archived hard copies for new estates but apparently that is all. Most drainage is Thames Water and access to this data,as view only, can be obtained by logging on to the Digdat site and registering. This will show the location of main drains etc. Other drains, culverts may be the responsibility of the Environment Agency and so they may be able to supply data. As we have not had the need for this in the past we have not investigate sources of information.	N/A	N/A	Drainage Network
LB of Newham	NEW_2E_NoData.txt	No data provided/available	N/A	N/A	Ordinary Watercourses
LB of Newham	NEW_3A_NoData.txt	3rd party aerial photography. Aerial photography is licenced only for LB of Newham internal use and so if this was needed for use by an external party an additional licence would need to be purchased to allow this.	N/A	N/A	Aerial Photography

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
LB of Newham	NEW_3B_NoData.txt	DTM can be obtained if required under license	N/A	N/A	LiDAR
LB of Newham	NEW_4A_NoData.txt	See Multi-Agency Flood Plan – first draft. Being updated. Item 5A.	N/A	N/A	Flood Key Infrastructure
LB of Newham	NEW_4B_NoData.txt	No major schemes. Borough are putting processes/practices into place to improve flood risk management and reduce risk of flooding, e.g. flood champion in council who reports to executive, MA Flood Plan, Flood Risk Register, actively bidding for funding to improve flood risk – recently (6 months ago) submitted two bids to Defra for funding but these were unsuccessful. Environment Agency has yet to confirm why they were unsuccessful.	N/A	N/A	Flood Improvement Scheme
LB of Newham	NEW_4C_NoData.txt	SUDS is promoted in the London Plan and will be reinforced in policy and guidance as part of our LDF. We haven't got (quality) information on the number of permissions that have been granted with SUDS incorporated into the design response but this may be something we monitor in the future. Though it will be difficult to do because SUDS scheme can include simple measures through to settling ponds and rainwater harvesting – it may be difficult to define SUDS for the purposes of monitoring.	N/A	N/A	SUDS
LB of Newham	Newham_SFRA.zip	SFRA - May 2010.	No known limitations. Published May 2010.	2	SFRA
LB of Newham	NEW_4E_NoData.txt	Two bids produced involved studies into local problem areas. See Item 1D for North Woolwich Bids	N/A	N/A	SFRA
LB of Newham	NEW_4F_NoData.txt	No major flood incidents in Borough in recent times but council have looked into areas of potentially major flood risk recently, particularly in North Woolwich Town area. If there was a major incident would be analysed by council. Council recovery plan sets out response following major incident such as flooding.	N/A	N/A	Flood Major Incidents
LB of Newham	NEW_4G_NoData.txt	No data available.	N/A	N/A	Flood Insurance Claims
LB of Newham	NEW_4H_NoData.txt	Records are kept of council owned property and any maintenance to these. Newham Homes maintain council property.	N/A	N/A	Housing Maintenance
LB of Newham	NEW_4I_NoData.txt	Probably not. Would receive information and pass on to relevant departments.	N/A	N/A	Flood Calls
LB of Newham	NEW_4J_NoData.txt	Not kept centrally but are aware of some areas like North Woolwich Town which are likely to flood badly during severe weather.	N/A	N/A	Severe Weather Streets
LB of Newham	NEW_4K_NoData.txt	Check SFRA - Item 4D.	N/A	N/A	Balancing Pond
LB of Newham	NEW_4L_NoData.txt	See Multi-Agency Flood Plan - Item 5A.	N/A	N/A	Critical Assets
LB of Newham	NEW_4M_NoData.txt	None.	N/A	N/A	Historic Sewer Records

Organisation	File	Information from Supplier	Limitations, uncertainty or perceived weakness	Review Score	Keyword
LB of Newham	NEW_4N_NoData.txt	Planning team may have information about new developments but no information provided.	N/A	N/A	Historic Drainage Assets
LB of Newham	NEW_4O_NoData.txt	See SFRA - Item 4D.	N/A	N/A	Ordinary Watercourses
LB of Newham	5A_LBN MAFP (draft 26.03.10) some maps removed.doc	First draft version. Exercises will be testing out the draft. Exercise Watermark – nationwide exercise to test out flood resilience. Outputs of exercises will feed back into plans as part of continual improvement.	No known limitations. Draft version - check for updates.	2	Multi-Agency Flood Plan
LB of Newham	5B_Adverse weather plan actual.doc	Separate severe weather plan. Covers flooding but in no great depth.	No known limitations.	2	Severe Weather Plan
LB of Newham	NEW_5C_NoData.txt	None.	N/A	N/A	Community Flood Plan
LB of Newham	NEW_5D_NoData.txt	Covered by MA Flood Plan and covered by planning and regeneration – planning commissions.	N/A	N/A	Flood Management Plan
LB of Newham	NEW_5E_NoData.txt	Council now has a flood working group to lead on and manage all flood related projects. They currently do not have a flood specific scrutiny panel. Council have started to look at setting up overview and scrutiny committee for flooding.	N/A	N/A	Scrutiny Panel Report
LB of Newham	NEW_5F_NoData.txt	Council have a Corporate Emergency Plan that deals with all types of emergencies and have MA Flood Plan that looks at flood specific emergencies.	N/A	N/A	Emergency Flood Plan
LB of Newham	NEW_5G_NoData.txt	Would be held by Planning Team and may include Flood Risk Assessments. Not provided.	N/A	N/A	Surface Water Management Plan
LB of Newham	NEW_5H_NoData.txt	Highways team would manage this. See Item 1C.	N/A	N/A	Road Gulley Cleaming
LB of Newham	NEW_5I_NoData.txt	Highways (road) and Newham Homes (properties).	N/A	N/A	Asset Maintenance
LB of Newham	LocalDevelopmentScheme2009.pdf	The latest LDF can be found here: http://www.newham.gov.uk/planning/planningpolicy Newham intend to consult on options policy direction for the Core Strategy late September and pre-submission late November, with submission late March. Following this, we will progress development management DPD and SPDs. These are the LDF documents which will include policy on flood risk and water.	No known limitations.	2	LDF Process
LB of Newham	Core Strategy Documents.zip	See response to 6A. Spatial strategy for housing and employment uses will be detailed in the next consultation in late September.	No known limitations.	2	Core Strategy Development Plans

Appendix B – Asset Register Recommendation

Introduction

The Flood and Water Management Act (FWMA) 2010, require that each Lead Local Flood Authority (LLFA) has a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The FWMA requires that the register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.

As of the 6th April 2011, all LLFAs will need to maintain a register. Defra have determined the legal characteristics of the register and records, this is provided in Table B1 below:

	Register	Record
a.	Must be made available for inspection at all reasonable times.	Up to the LLFA to decide if they wish to make it available for inspection
b.	Must contain a list of structures or features which in the opinion of the authority, are likely to have a significant effect on a local flood risk.	For each structure or feature listed on the register, the record must contain information about its ownership and state of repair.
c.	s.21 (2) of the FWMA allows for further regulations to be made about the content of the register and record. There is currently no plan to provide such regulations therefore their content should be decided on by the LLFA depending on what information will be useful to them.	
d.	There is no legal requirement to have a separate register and record although as indicated above, only the register needs to be made available for public inspection.	

Table B1. Asset Register Requirements

Source: Defra, 2011 Lead Local Flood Authority Duty to Maintain a Register)

The creation of the asset register was outside of the scope of the Drain London project and is the responsibility of the LLFA. It is recommended that the LLFAs utilise a risk-based approach to the creation of the register, and begin recording structures or features which are considered the have the greatest influence on flooding. This appendix highlights assets and methods for their capture within the register and should be utilised as a guideline only.

Review and Recommendations

As part of the Drain London project, a review of the London Borough (LB) of Newham's asset information was undertaken and recommendations have been put forward as to how best to fulfill the requirements of the Flood and Water Management Act 2010.

LB of Newham's existing asset management system has been reviewed against the following criteria:

- Level 1 – The borough knows where their assets are, what they look like and what condition they are in. Register system may take the form of a spreadsheet or hard copy records.

- Level 2 – The borough is aware of the 'Local Authority Flood Risk Asset Tool' currently being produced by the EA / Defra. Their register is GIS based (basic proprietary system only) or uses a highways based asset management system database. Their register captures information generally aligned with guidance provide by the Tool and the EA NFCDD system where practical. They know where their assets are and carry out reactive maintenance of significant structures as required.

- Level 3 – The borough has a detailed understanding of Asset Registers as required by the Flood and Water Management Act. Their register system accurately replicates the 'Local Authority Flood Risk Asset Tool' data standards and related NFCDD structures to an attribute level. Their register is GIS based (advanced proprietary or bespoke system) or is completely integrated with an existing asset management system. They know where their assets are and carry out periodic maintenance on the structures using a risk based priority system.

LB Newham provided limited asset information as part of the Drain London Tier 1 'data collection' exercise and based on the current review of the asset register appears to be Level 1.

In order to achieve a 'Level 3' status, it is recommended that the Council obtain and maintain the information identified within Table B2. If any additional information is required by the Council, then it is recommended that where possible this is incorporated into a Geographical Information System (GIS) system (MapInfo, ArcGIS, AutoCAD etc) and captured within a relevant Council database.

Data	Format	Recommendations
Highway flooding and drainage records – including location and serviceability of road gulley's.	GIS	Compile and maintain: • GIS layer of Highway flooding • GIS Layers of drainage network flooding. • GIS layer of gullies with serviceability state; • Where possible hyperlink imagery of flooding and anectodatl information from external sources (newspapers, websites, blogs etc)
Drainage network information – sewers (surface, foul, combined), culverts, drains (surface water, highway), gullies, ditches, other open drainage channels	GIS	Compile and maintain GIS layers of: • Sewers (surface, foul, combined) • Culverts from PDFs • Drains (surface water, highway) • Gullies • Ditches • Other open drainage channels Include hyperlinked imagery of necessary information to improve identification in the field.
Local Authority led flood risk improvement schemes	Database and GIS	Maintain a living document which records all such scheme details and contact details. Map locations of the scheme including hyperlinks to photos, design drawings, and pre and post construction information including imagery during rainfall events and any information recorded during the schemes operational life.

Data	Format	Recommendations
SUDS schemes information (Council adopted SUDS)	GIS and Database	Maintain a living document which records all Council adopted scheme details and contact information. Map locations of the scheme(s) including hyperlinks to photos, design drawings, and pre and post construction information including imagery during rainfall events and any information recorded during the schemes operational life. A copy of the maintenance management plan should be hyperlinked within the GIS layer and database.
SUDS schemes information (Privately owned SUDS schemes)	GIS and Database	Hyperlink development application information within the GIS system including: • Flood Risk Assessments, Feasibility Studies, Detailed Drainage Studies, etc; • Hyperlinks to photos, design drawings, and pre and post construction information - including imagery during; construction, rainfall events and any information recorded during the schemes operational life. • Approved maintenance management plan; • This should also capture the development connection point and any other relevant drainage information. When available, include operational phase information and any field results.
Pond and lake information (not included as SUDS)	Database and GIS	Keep a living document which records all details of these features along with a GIS layer detailing asset (name, purpose, maintenance) and location information.
Critical local asset records (assets which are known to, or have the potential to flood)	GIS	Compile GIS layer of Critical local asset records. Include hyperlinks to images of these assets for easy field identification.
Historic sewer records (if any)	GIS	Inquire if any specific flood records can be made are available from Thames Water. Where available, include drawings/photos of historical events and compile a GIS layer/database of historic sewer records available. Where images are available this should be hyperlinked linked within the GIS system.
Historic construction records of drainage assets	GIS	Locate and create GIS layer of plans and drawings relating to foul and surface water drainage. Where possible these should be hyperlinked within the GIS system,.
Capacity and condition of 'ordinary' watercourses essential to operation of the urban drainage systems, including culverted watercourses and flow models (where they exist).	GIS	Compile GIS layer of capacity and condition of 'ordinary' watercourses. Include hyperlinked images of key structures and features (possibly walls, spillways etc) of the watercourse.

Data	Format	Recommendations
New development drainage studies and supporting information	Database	Collate new development drainage studies and supporting information. Hyperlink development application information within the GIS system (including Flood Risk Assessments, Detailed Drainage Studies, Private development SUDs schemes etc) including post development connection and drainage information. When available, include operational phase information and any field results.
Road gulley cleaning/ maintenance records	Database	Create record and hyperlink imagery (where appropriate).of key gullies prone to flooding

Table B2 – LLFA Asset Register Recommendations

Appendix C1 – Surface Water Modelling

Introduction

Capita Symonds has constructed eight TUFLOW hydraulic models across the London Boroughs in Group 4. The extents of the models have generally been based upon catchment boundaries and not borough boundaries to limit the amount of cross-boundary interaction between models. This was carried out to limit the dependency of one model on the results of another. Consequently, the model results for each borough are divided over a number of models and in some cases have been modelled by more than one consultant. The following table outlines the models that cover the London Borough of Newham, along with the name of the final model, percentage coverage of the Borough by each model, and the names of any other Boroughs falling within the model extent. Figure 1 shows the extent of the models listed.

Consultant	Model Name	Naming Convention (100 year Flood Event)	Borough Coverage	Other Boroughs covered by the Model
Capita Symonds	Royal Docks	DLT2_G4RD_0100R_026	83%	None
Capita Symonds	Leyton	DLT2_G4LY_0100R_032	13%	None
Capita Symonds	Tower Hamlets	DLT2_G4TH_0100R_026	2%	Waltham Forest, Hackney, Redbridge
Jacobs/JBA	Roding Lower	Roding Lower#1 M100-180	2%	Barking and Dagenham, Redbridge

Table 1: Model coverage for the London Borough of Newham

The naming convention has generally been derived to reference the tier of work, the name of the model, the flood event being modelled and the version number. A standard naming convention was not adopted for all models built for the Drain London project, hence different conventions may have been adopted by other consultants.

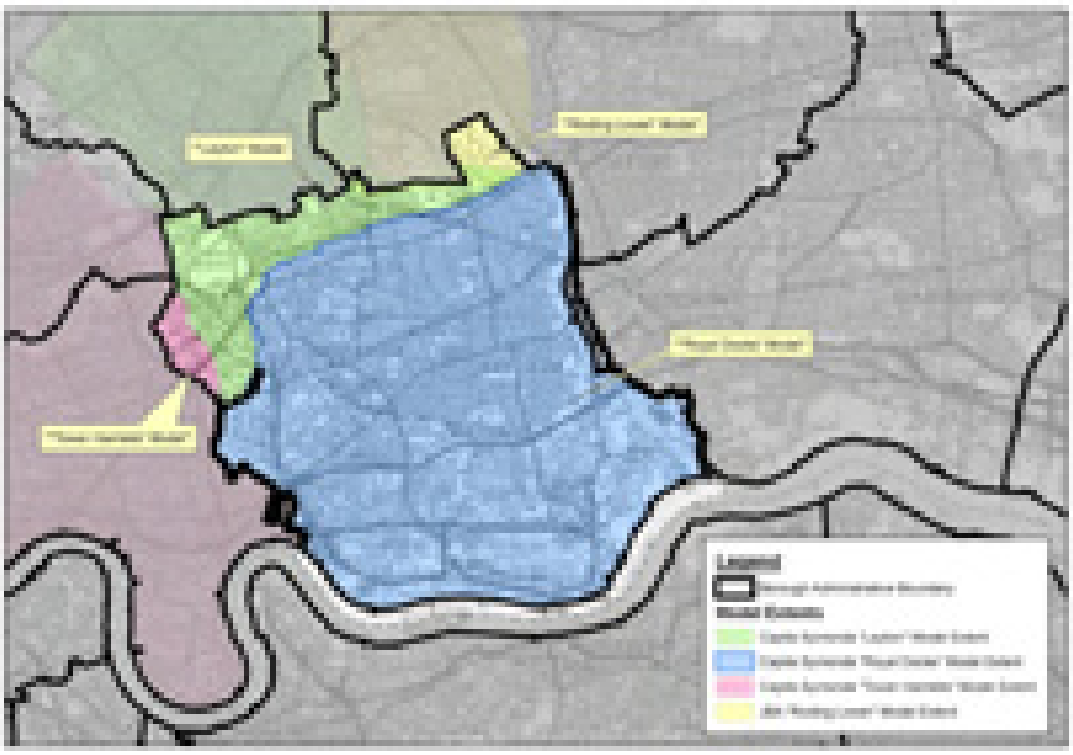


Figure 1: Model coverage for the London Borough of Newham

Software Version

All models have been run using TUFLOW build 2010-10-AA-iDP as agreed by all Drain London consultants using the TUFLOW software. All models in Newham Borough were run on the 64bit version of this build to take advantage of the faster simulation times and more advanced handling of larger models.

Model Parameters

All hydraulic models have been constructed following the guidance outlined in the Drain London: Data and Modelling Framework V1.0 (December 2010). The following sections of this appendix describe in more detail how this guidance was applied and where amendments or additions were made.

Direct Rainfall Methodology

The Drain London modelling was designed to analyse the impact of heavy rainfall events across each London Borough by assessing flow paths, velocities and catchment response. The Drain London Data and Modelling Framework specified that the direct rainfall method should be used in the modelling approach. This method incorporates conservative allowances for the drainage network and infiltration. The following key assumptions were made to generate the model input:

- Initial Loss – None
- Infiltration Loss – None
- Allowance for Drainage System – A constant value of 6.5mm/hr was applied
- No aerial reduction factor applied
- ‘Summer’ profile was used

To comply with the Drain London framework requirements rainfall inputs were generated at a standard 10km grid square resolution. As specified in the framework guidance hyetographs for the following rainfall events were generated:

- 1 in 30 year
- 1 in 75 year
- 1 in 100 year
- 1 in 100 year plus climate change (+30%)
- 1 in 200 year

Total rainfall depths at each 10km grid centroid for all required return periods were extracted from the FEH CD-ROM (v3) Depth Duration Frequency (DDF) model. A comparison between the peak rainfall depths in adjacent 10km grid squares was completed to confirm the suitability of the 10km grid resolution for modelling purposes. The difference in total rainfall depths between the grid centroids for 10km grid squares was mostly less than 5%, with the maximum difference being 17%. This suggests that the 10km grid data is suitable for use in the study as a finer grid would have a minimal effect on the hyetographs.

Critical duration is a complex issue when modelling large areas for surface water flood risk. The critical duration can change rapidly even within a small area, due to the topography, land use, size of the upstream catchment and nature of the drainage systems. The ideal approach would be to model a wide range of durations. However, this is not always practical or economic when modelling large areas using 2D models which have long simulation times – such as within the Drain London study.

A high level investigation was undertaken to understand the effect of rainfall event duration on the Drain London Study area using a rapid modelling technique. The intention of the investigation was to show variation in critical duration across the study area and thus identify whether it was possible to identify single critical durations for each sub-model. The study used the 1 in 100year hyetographs for 1, 3, 6 and 12 hour durations along with a simplified terrain model to route overland flow. The key result was that critical duration is highly variable across surface water catchments – but the influence was not sufficiently significant to justify considering multiple event durations within the Drain London Study. Therefore, a single duration of 3hrs was selected for all model runs to ensure result consistency and comparability across the Greater London area. It is strongly recommended that an analysis of possible result sensitivity to duration is considered for future studies.

Grid Size

All models within the boundary of the London Borough of Newham have been constructed with a 5m grid size, within the recommended range detailed in the Data and Modelling Framework. This grid size was chosen as it represented a good balance between the degree of accuracy (i.e. ability to model overland flow paths along roads or around buildings) whilst maintaining reasonable model run ("simulation") times. For example, refining the grid size from a 5m grid to a 2m grid is likely to increase the model simulation time from 21 hours to approximately 11 days.

Structures

Structures within the study area were generally modelled in 2D, an approach consistent with the strategic nature of the Drain London project. Structures modelled in 2D include those on watercourses and underpasses or culverts within the floodplain. The structures were modelled by using the ZSHP function in TUFLOW which allows the user to specify the object width representing the structure opening. Invert levels were determined by inspecting the LiDAR DTM with widths of structures either measured on site visits, from Google Maps, or from the LiDAR DTM.

The limitations of modelling structures in 2D, rather than as a 1D element, are that the width of the structures is limited by the grid size (i.e. structure width is a multiple of the grid size). The depth of water within the structure can also be over-estimated as rainfall is allowed to enter the structure from above and not just through the entrances of the structure. For this reason, only short structures (e.g. generally less than 40m) have been modelled in 2D.

A 1D modelling approach was therefore chosen for longer and more complex structures. These included structures such as the railway tunnel at Stratford International Station. The dimensions of these structures were estimated using the same method as for 2D structures. The roughness value for each structure was selected from the list of materials values agreed amongst all Drain London consultants. All structures modelled in 1D are listed in Table 2.

In some cases, the length of the tunnel was significant or the exit of the tunnel was in another London Borough or model (i.e. tunnel east of Stratford International Station). In these situations, only the entrance of the structure was modelled and a 1D free-flow (stage vs time) boundary was attached to the downstream end. This approach has been agreed amongst all Drain London consultants. As the modelling of these structures has been simplified, the model results at these locations should be verified by undertaking more detailed modelling, particularly for critical structures.

Node Label	NGR	Location Description	Modelled Length (m)	Roughness
RD_001*	541600, 180760	Disused railway tunnel beneath A1020, northern entrance	300	0.05
RD_001A*	541680, 180620	Disused railway tunnel beneath A1020, southern entrance	260	0.05
RD_002	543410, 180860	DLR tunnel underneath A1020 Royal Albert Way	120	0.05
RD_003*	543730, 181500	Railway tunnel beneath A1020, western entrance	66	0.05
RD_003A*	543760, 181490	Railway tunnel beneath A1020, eastern entrance	6	0.05
G4LY_001+	537650, 184750	Stratford International Rail Station, tunnel east of station	74	0.05
G4LY_002*	538490, 185090	Stratford International Rail Station, northern approach tunnel	57	0.05
G4LY_004*	538450, 184850	Stratford International Rail Station, tunnel northeast of station	70	0.05
G4LY_005*	539000, 184770	Stratford International Rail Station, eastbound tunnel	460	0.05
G4LY_006*	538540, 184400	Stratford LU Station, northern approach tunnel	150	0.05
G4LY_007*	538520, 184380	Stratford LU Station, northern approach	130	0.05

Node Label	NGR	Location Description	Modelled Length (m)	Roughness
		tunnel		

Table 2: List of Structures modelled in 1D in the Borough of Newham
* Only the entrance to the structure has been modelled as the low point is the middle of the tunnel and therefore water would enter the tunnel and then pond. This is represented by modelling both entrances for a short length.
+ Only the entrance has been modelled as the tunnel's exit is located outside of the model extents.

Adjustments to Topography

When reviewing the model's representation of the LiDAR DTM, it was observed in some locations of new development that excavation pits had been captured by the DTM whereas aerial photos showed buildings. Where this occurred in critical areas of the model or where the pits were particularly large, these were manually filled in to match the elevation of surrounding areas.

Building Footprints

Building footprints have been largely represented in the model as outlined in the Data and Modelling Framework. In situations where the polygon representing the building was large or long, the use of a single elevation to represent the floor level resulted in parts of the building being raised metres above the surrounding ground level. This can therefore misrepresent the potential for the building to flood. In these cases, the building 'polygon' was assigned a varying elevation such that the finished floor level remained 100mm above the ground level across the area of the polygon.

Runoff Coefficients

The runoff coefficients applied to the hydraulic models were in line with those stated in the Drain London Data and Modelling Framework. The runoff coefficients were applied to the rainfall profiles in order to represent the varying level of infiltration on each surface, therefore altering the input data directly.

Formal and Informal Defences

A GIS layer containing defences from the Environment Agency's NFCDD dataset was provided. These defences have been included in all models. Where additional data was provided by the Borough or informal defences such as walls were observed on site or through Google Maps, these were included in the model where it was thought that their presence would influence surface water flowpaths. The defacto defences are listed in Table 3.

Type of Defence	NGR	Description of Location
Concrete Wall	538190, 184990	Adjacent to rail tracks north of Stratford International Rail
Concrete Wall	538170, 184760	Surrounding new Stratford International Rail station
Railway Embankment	539350, 183030	Rails south of West Ham station on the London Underground District line and Hammersmith and City line
Earth Embankment	541300, 182500	Greenway cycle path through Newham
Earth Embankment	541630, 181960	Adjacent A13 and housing on Sheerwater Road in Beckton
Earth Embankment	543580, 182570	Adjacent to A13 and Gooseley's Playing Field in Beckton

Earth Embankment	543410, 184550	Adjacent to the A406 and the sports ground in Wallend

Table 3: List of Structures modelled in 1D in the Borough of Newham

Model Boundaries

Downstream boundaries in the models were included where it was observed that water was able to flow outside of the model extent. This might include locations where water was found to flow into a neighbouring catchment or model. The type of downstream boundary generally used was a flow vs. stage (level) relationship, or HQ boundary. These were applied to the 2D component of the models only. The rating relationship is generated by TUFLOW automatically using a gradient provided by the modeller. The 'outflow' from the model is then applied as an 'inflow' to the downstream model.

There are a number of 2D downstream boundaries included within all models within Newham; these have mainly been located on roads that make up overland flow routes for the surface water.

Cross-Boundary Issues

In some cases, it was not possible to avoid interaction with a neighbouring model due to the nature of the topography. To ensure that the flowpath is represented correctly, at all locations of possible overland flow, a downstream boundary was positioned, and flow recorded. All recorded flow at the boundaries within Newham was deemed minimal so did not require inputting into the neighbouring model.

Simulation Time

All models were initially run for six hours in compliance with the Data and Modelling Framework document. The models were then assessed to determine whether this duration was suitable for each specific model. This was carried out by viewing the model results for the final few timesteps. The results were checked to determine if water depths were still increasing significantly, and whether new flowpaths were forming or existing flowpaths still propagating. If either of these conditions were found to exist, the simulation time was extended for a further hour after which the checks were repeated until none of the conditions were satisfied. The simulation times for each of the models within the London Borough of Newham have been listed below in Table 4:

Model Name	Model Simulation Time (hrs)
DLT2_G4RD_0100R_026	6
DLT2_G4LY_0100R_032	7
DLT2_G4TH_0100R_026	7
Roding Lower#1 M100-180	6

Table 4: Model simulation times

Sensitivity Testing

The sensitivity of the model results to changes in drainage loss was tested. This was carried out for all models on the 1 in 200 year return period flood event. The original drainage loss of 6.5mm/hr was adjusted by +/-25% giving values of 8.125mm/hr and 4.875mm/hr to be used for the analysis. The two sensitivity test results were compared with the baseline results by producing a depth difference grid. This output shows the difference in depth as a result of the change in drainage loss. The model results are deemed to be sensitive to changes in the tested parameter, if the percentage change in depth is greater than the percentage change in the parameter.

As a whole, the models in the Newham Borough were not found to be sensitive to changes in drainage loss. Changes in maximum depth were less than 25% compared to the baseline results. A number of intermittent locations in the models did show a larger change in depth. These were generally located in areas where there are sudden changes in elevation, i.e. at railway cuttings and road embankments.

Model Stability

Assessing the stability of a model is a critical step in understanding the robustness of a model and its ability to simulate a flood event accurately. Stability in a TUFLOW model can be assessed by examining the cumulative error (or mass balance) of the model as well as the warnings outputted by the model during the simulation.

As can be seen in Figures 3 to 5 below, the cumulative error of the models in the Borough is largely within the recommended range of +/-5% for the majority of the simulation. High values are reported at the beginning of the rainfall event when the model cells first wet then settle down for the remainder of the simulation. The cause and location of the high cumulative errors was investigated by examining a number of other output files provided by TUFLOW. The high values were found to occur at random locations throughout the study area for a single timestep and were not found to persistently occur at a single cell. This suggests that the high cumulative error is a consequence of the initial wetting process at the start of the rainfall event. The high cumulative error values are therefore considered to have a negligible impact on the overall model results.

Between 3-32 warning messages are outputted for the models in Newham Borough through the simulation for each of the five flood events. The warnings relate to areas of poor convergence, or in other words, where TUFLOW has had trouble finding a solution. The warnings were found to be spatially varied and non-persistent in time, which is a relatively common occurrence in these types of models. As the warnings were not found to repeatedly occur, these have a negligible impact on the overall model results and the model is considered fit for purpose.

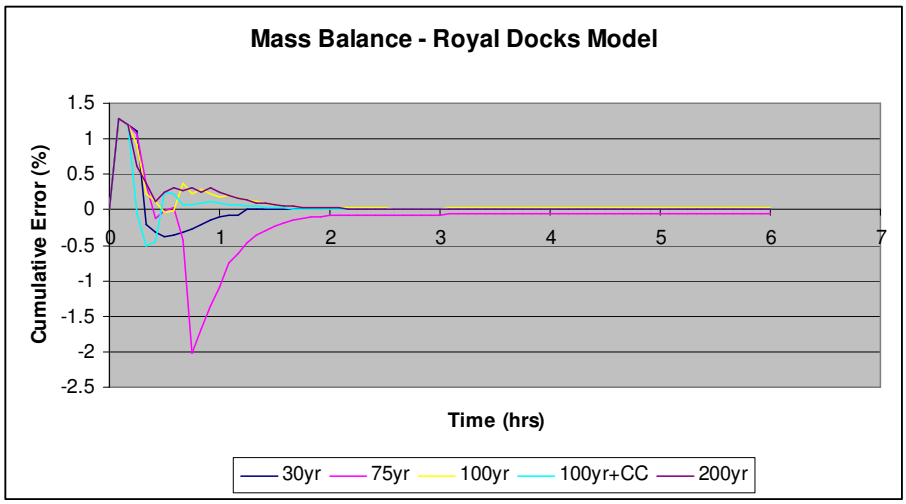


Figure 3: Mass Balance of Royal Docks Model

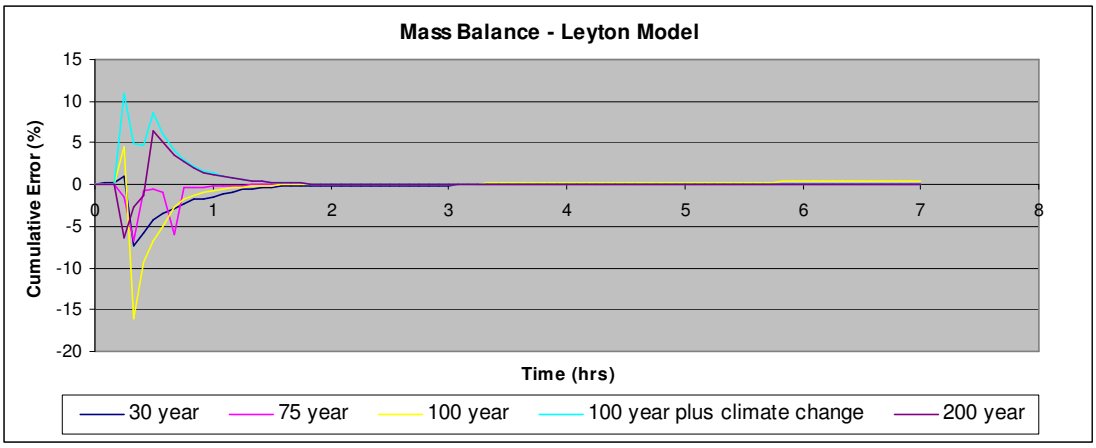


Figure 4: Mass Balance of Leyton Model

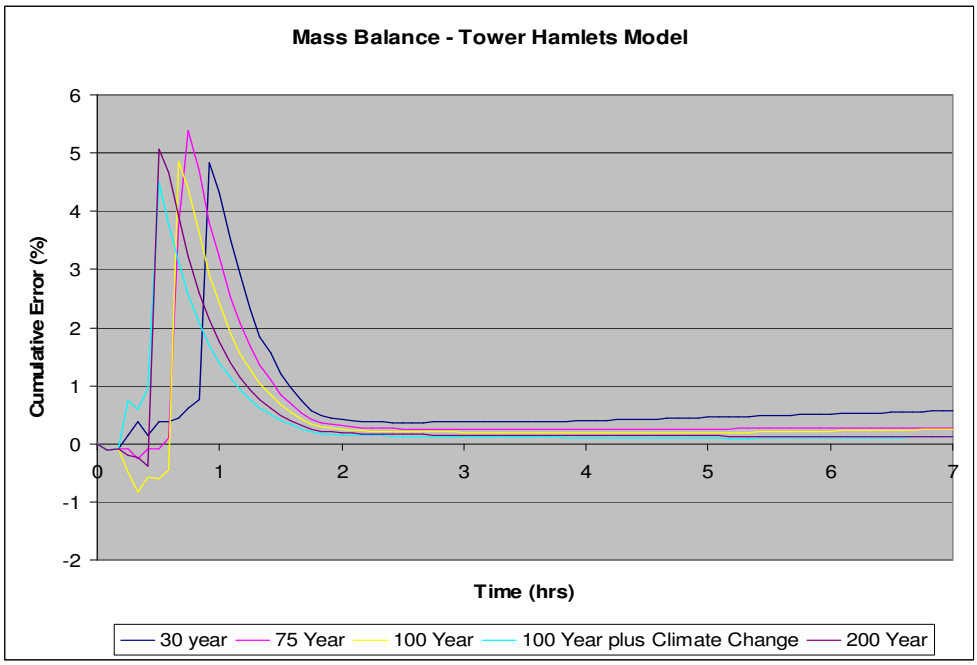


Figure 5: Mass Balance of Tower Hamlets Model

Conclusions and Recommendations

The hydraulic models constructed for Phase 2 of the Drain London project represent a strategic approach to identify areas at risk of surface water flooding. It represents a significant refinement on the previously available information on surface water flooding in Newham. The models and their mapped results should only be used after a thorough review of this technical appendix and the Drain London Data and Modelling V1.0 (December 2010). Recommendations for future improvements to the models include (but are not limited) to the following:

- Explicitly model the existing drainage network in key areas of risk, as opposed to a London wide assumption on drainage capacity;
- Inclusion of survey data for critical structures;
- Inclusion of river flows and channel capacity (where applicable);
- Reduction in model grid size in key areas of risk;
- Testing of different storm durations;

- Inclusion of defacto defences outside of the scope of the Drain London project (e.g. assets identified through the Asset Register process); and
- The use of better quality or more up to date topographic information particularly in areas of recent development

Appendix C2 – Groundwater

Introduction

As part of the Drain London project Drain London Tier 1 consultants commissioned Jacobs/JBA to produce a dataset referred to as the Increased Potential Elevated Groundwater (iPEG) maps. The assessment was carried out at a Greater London scale. The iPEG mapping assists in identifying areas which have an increased potential to experience groundwater flooding. The iPEG map shows those areas within the borough where there is an increased potential for groundwater to rise to within 2m of the ground surface. When groundwater rises to this level water may be able to enter below ground structures such as basements and communications networks and continue rising to cause surface water flooding. The iPEG map includes an assessment of the potential groundwater to rise in both consolidated aquifers and from superficial permeable deposits (unconsolidated aquifers). The map also includes those areas close to rivers which are underlain by permeable superficial deposits where groundwater may rise to elevated levels driven by high water levels in the river.

Methodology

Large areas within the Drain London area are underlain by permeable substrate and thereby have the potential to store groundwater. Under some circumstances groundwater levels can rise and cause flooding problems in subsurface structures or at the ground surface. The mapping technique described below aims to identify only those areas in which there is the greatest potential for this to happen.

Four data sources have been utilised to produce the increased Potential for Elevated Groundwater map. These data sources are the:

- British Geological Survey (BGS) Groundwater Flood Susceptibility Map;
- Jacobs Groundwater Emergence Maps (GEMs);
- Jeremy Benn Associates (JBA) Groundwater Flood Map; and
- Environment Agency/Jacobs Thames Estuary 2100 (TE2100) groundwater hazard maps.

To produce the iPEG map for consolidated aquifers, an area was defined as having increased potential for elevated groundwater levels if at least two of the three mapping techniques listed above produced a corresponding area. For the permeable superficial deposits, only Band 1 Very High of the BGS and the TE2100 data were used as this was judged to best represent the hazard.

A description of each of the four data sets and how it was used in the production of the iPEG map is summarised in Table 1 below. The iPEG map should be viewed with careful consideration of the strengths and disadvantages of each of the four data sets.

Table 1 Summary of Data Used in the Production of the iPEG Map

	BGS Groundwater Flood Susceptibility Map	Jacobs Groundwater Emergence Map	JBA Groundwater Flood Map	Jacobs TE2100 Groundwater Maps
Mechanisms considered / hydrogeological coverage	Clearwater flooding through all consolidated aquifers and groundwater flooding through Permeable Superficial Deposits (PSD)	All major consolidated aquifers	Unconfined Chalk and Permeable Superficial Deposits	Groundwater emergence in Permeable Superficial Deposits in hydrological continuity with river levels.
Methodology	• Identify from geology where groundwater flooding could not occur • For all other areas, produce a groundwater level surface from National Groundwater Level data, modified to best represent groundwater flooding • Compare the groundwater level surface with the DTM and determine susceptibility to groundwater flooding based on depth to groundwater	Three scenarios: • Where flooding was reported and groundwater contours were available, groundwater emergence zones were defined such that they encompassed incidents of observed flooding. • Where no flooding was reported or no data supplied, but groundwater contours were available, then groundwater emergence zones were based on generalised aquifer properties and observation borehole levels. • Where no groundwater contour information was available, river network classified by BFIHOST was used to identify susceptible areas	For the Chalk maps: • Develop water level – frequency relationships at available boreholes • Extrapolate this relationship to un-gauged locations • Compare water level surface with DTM for mapped events	• Identify from geology areas of permeable superficial deposits • Identify mean water level in the Thames Estuary (and tidal watercourses) which will drive the groundwater head • Determine likely distance from the estuary (and tidal watercourses) over which groundwater levels could be influenced • Identify areas where the groundwater level could rise to the level in the estuary and be within 2m of the ground surface

	BGS Groundwater Flood Susceptibility Map	Jacobs Groundwater Emergence Map	JBA Groundwater Flood Map	Jacobs TE2100 Groundwater Maps
Data used in the production of the maps	BGS 1:50 000 geological mapping, with classifications of permeability, NextMap 5m DTM, National Groundwater Level data on a 50m grid.	50m resolution IHDTM; groundwater contour data from EA and BGS for all major aquifer units from various dates; borehole level data; recorded observations of groundwater flooding from 2000/1.	Borehole records from the EA; 5m DTM from Infoterra and 1:625 000 scale geological mapping	BGS 1:50 000 geological mapping, LiDAR data at 2m resolution and information on mean water levels and defence crest heights.
Strengths	• Considers consolidated and superficial aquifers • Based on National Groundwater Level data • Calibrated on winter 2000/1 observations of flooding • Provides number of classes of susceptibility to indicate sensitivity • Could select only highest susceptibility bands	• Calibrated on winter 2000/1 observations of flooding	• Provides explicit representation of 1 in 100 chance outline • Provision of up to three event probabilities could enable sensitivity testing • Calibrated on winter 2000/1 observations of flooding	• Considers an important mechanism not considered by other methods • Important mechanism in east London.
Disadvantages	• Outlines are not explicitly linked to event probabilities • Maps may indicate overly-large areas as susceptible to groundwater flooding	• Does not consider PSD • Outlines are not explicitly linked to event probabilities • Regional scale	• PSD map based on 1:50k background.	• Determination of distance from estuary over which groundwater levels could be influenced could be improved • Could consider an upward slope on groundwater levels away from the estuary

How to Use and Interpret the Map

The increased Potential for Elevated Groundwater map shows those areas within the borough where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2 m of the ground surface.

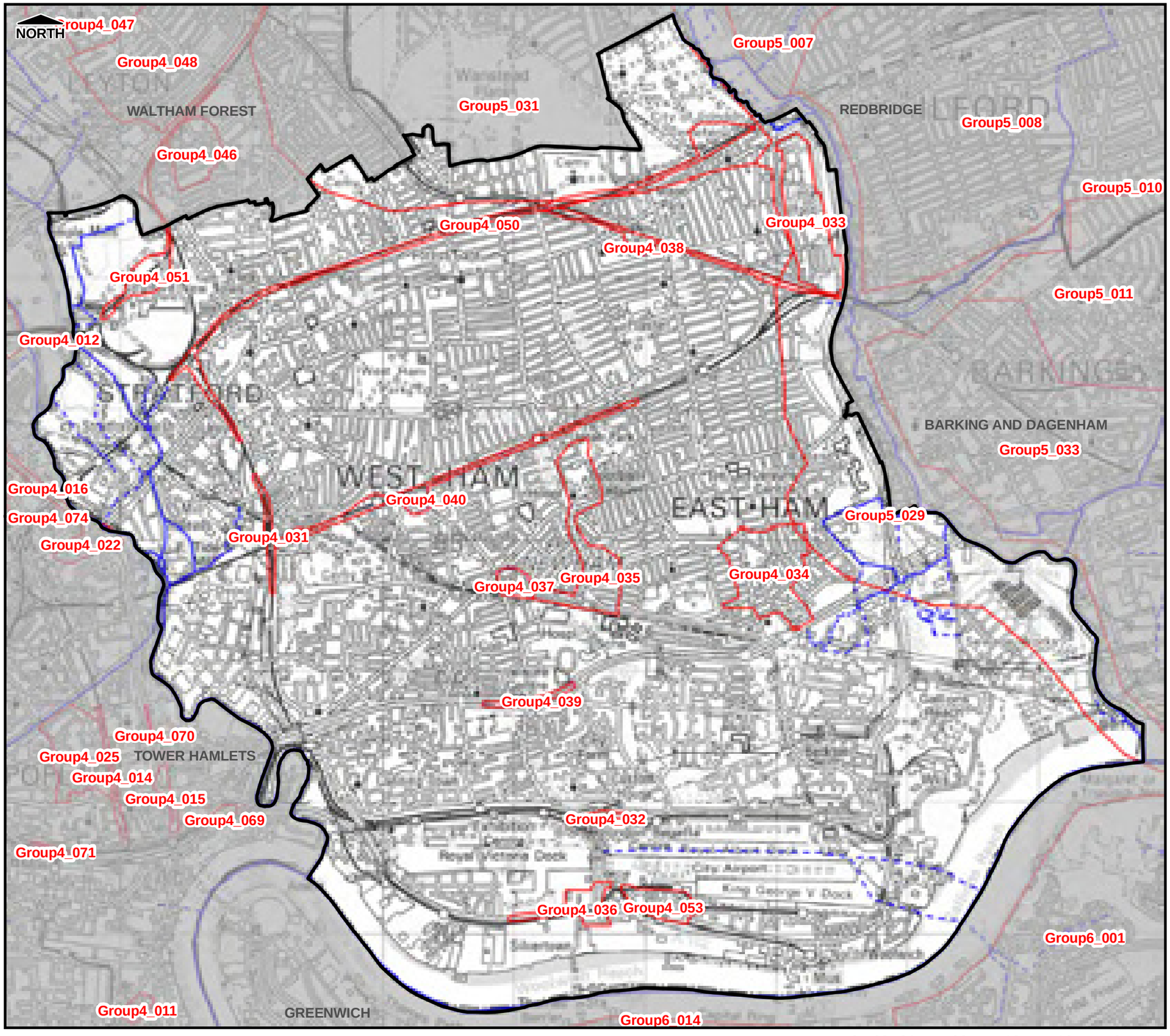
Groundwater may become elevated by a number of means:

- Above average rainfall for a number of months in Chalk outcrop areas;
- Shorter period of above average rainfall in permeable superficial deposits;
- Permeable superficial deposits in hydraulic continuity with high water levels in the river;
- Interruption of groundwater flow paths; and
- Cessation of groundwater abstraction causing groundwater rebound.

With the exception of groundwater rebound which is not covered, the iPEG map will identify those areas most prone to the mechanisms described above. The map shows those areas considered to have the greatest potential for elevated groundwater. Additional areas within the London Boroughs have permeable geology and therefore could also produce elevated groundwater levels. However, to produce a realistic map, only where there is the highest degree of confidence in the assessment are the areas delineated. This ensures resources are focused on the most susceptible areas. In all areas underlain by permeable substrate, groundwater should still be considered in planning developments.

Within the areas delineated, the local rise of groundwater will be heavily controlled by local geological features and artificial influences (e.g. structures or conduits) which cannot currently be represented. This localised nature of groundwater flooding compared with, say, fluvial flooding suggests that interpretation of the map should similarly be different. The map shows the area within which groundwater has the potential to emerge but it is unlikely to emerge uniformly or in sufficient volume to fill the topography to the implied level. Instead, groundwater emerging at the surface may simply runoff to pond in lower areas.

For this reason within iPEG areas, locations shown to be at risk of surface water flooding are also likely to be most at risk of runoff/ponding caused by groundwater flooding. Therefore the iPEG map should not be used as a “flood outline” within which properties at risk can be counted. Rather it is provided, in conjunction with the surface water mapping, to identify those areas where groundwater may emerge and if so what would be the major flow pathways that water would take.



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Critical Drainage Areas
- Main River
- Ordinary Watercourse
- Culverted Watercourse

Notes

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	04/07/2011	D.HUGHES	S.IP

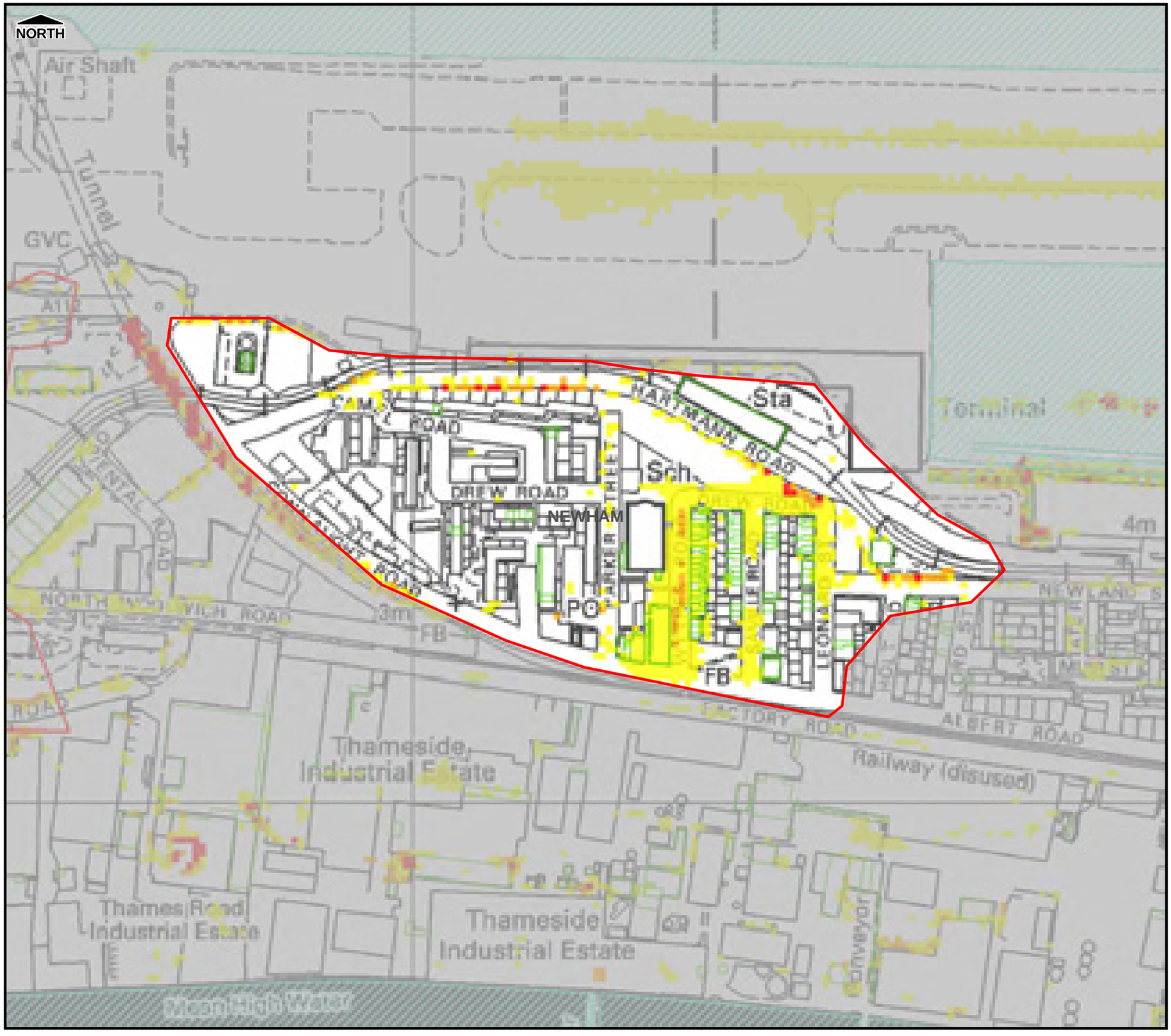
Critical Drainage Area Index Map

Consultants
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

Drain London Programme Board Members

FIGURE 1

Filepath: L:\Environment\zwetCS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig1_CDA_Index.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
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3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	04/05/2011	D.HUGHES	S.IP

Critical Drainage Area 053
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
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London
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Drain London Programme Board Members

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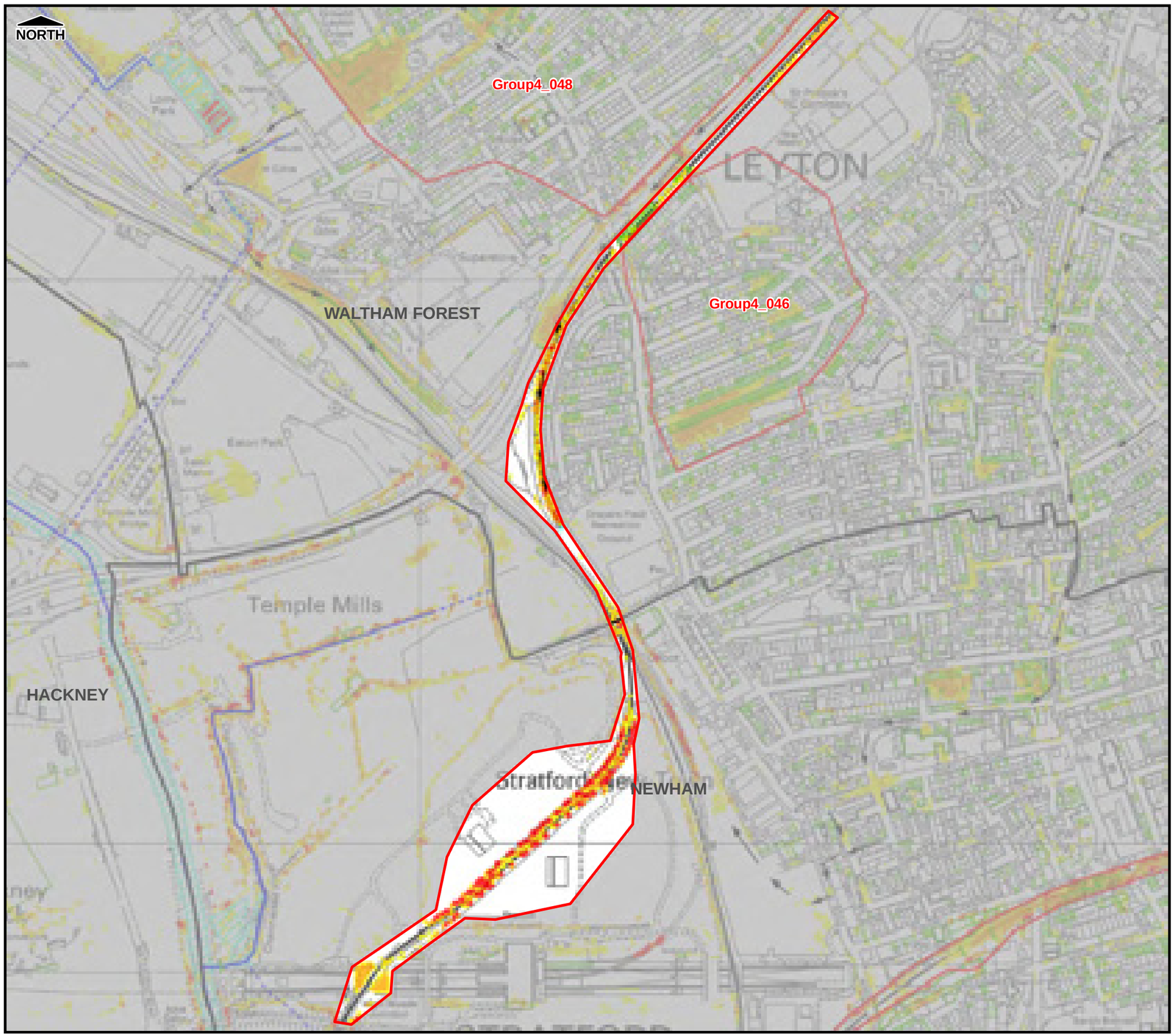
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA053.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
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   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:7,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 051
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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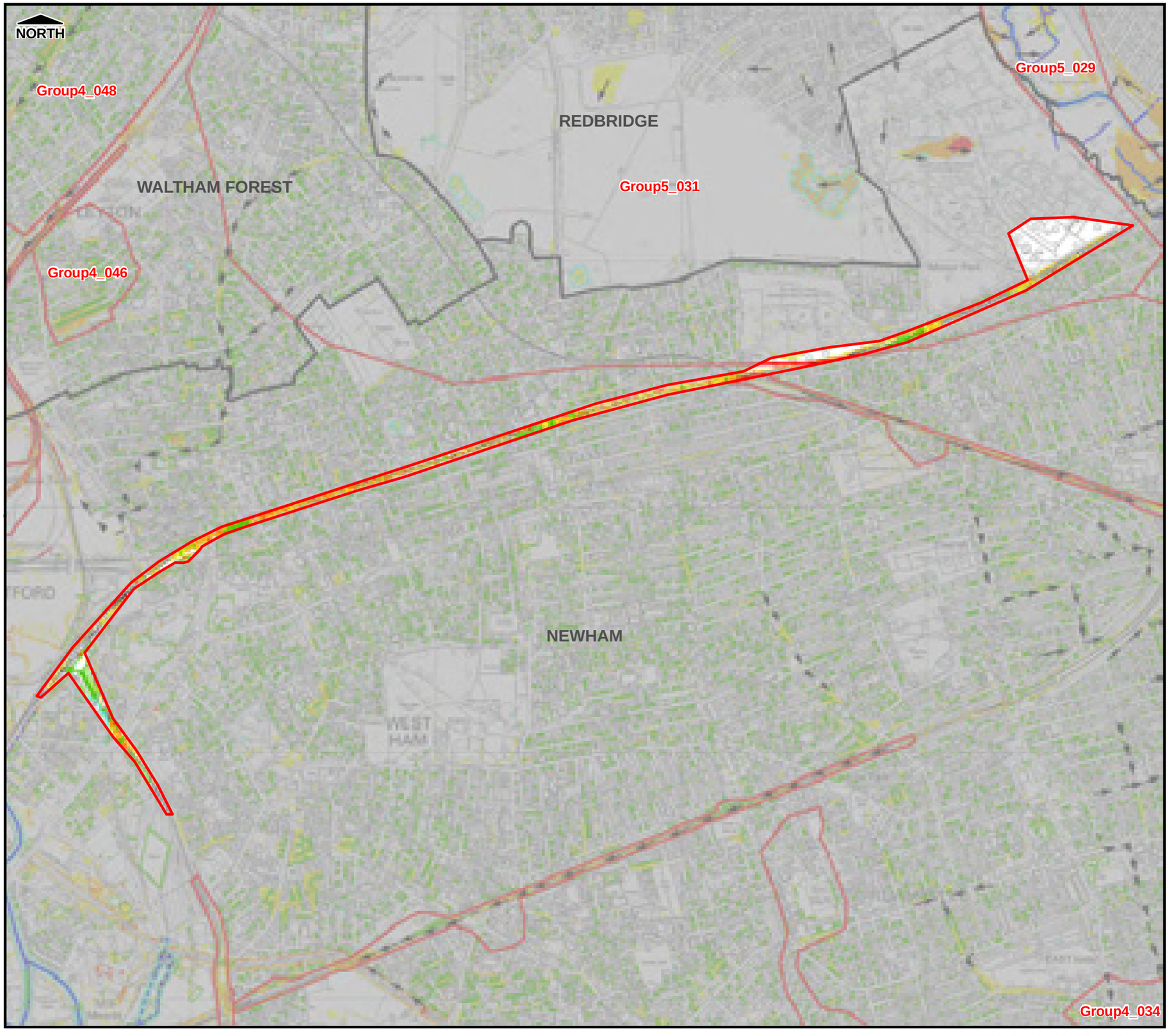
FIGURE 24

Filepath: L:\Environment\zwetCS\046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA051.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
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   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:16,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 050
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

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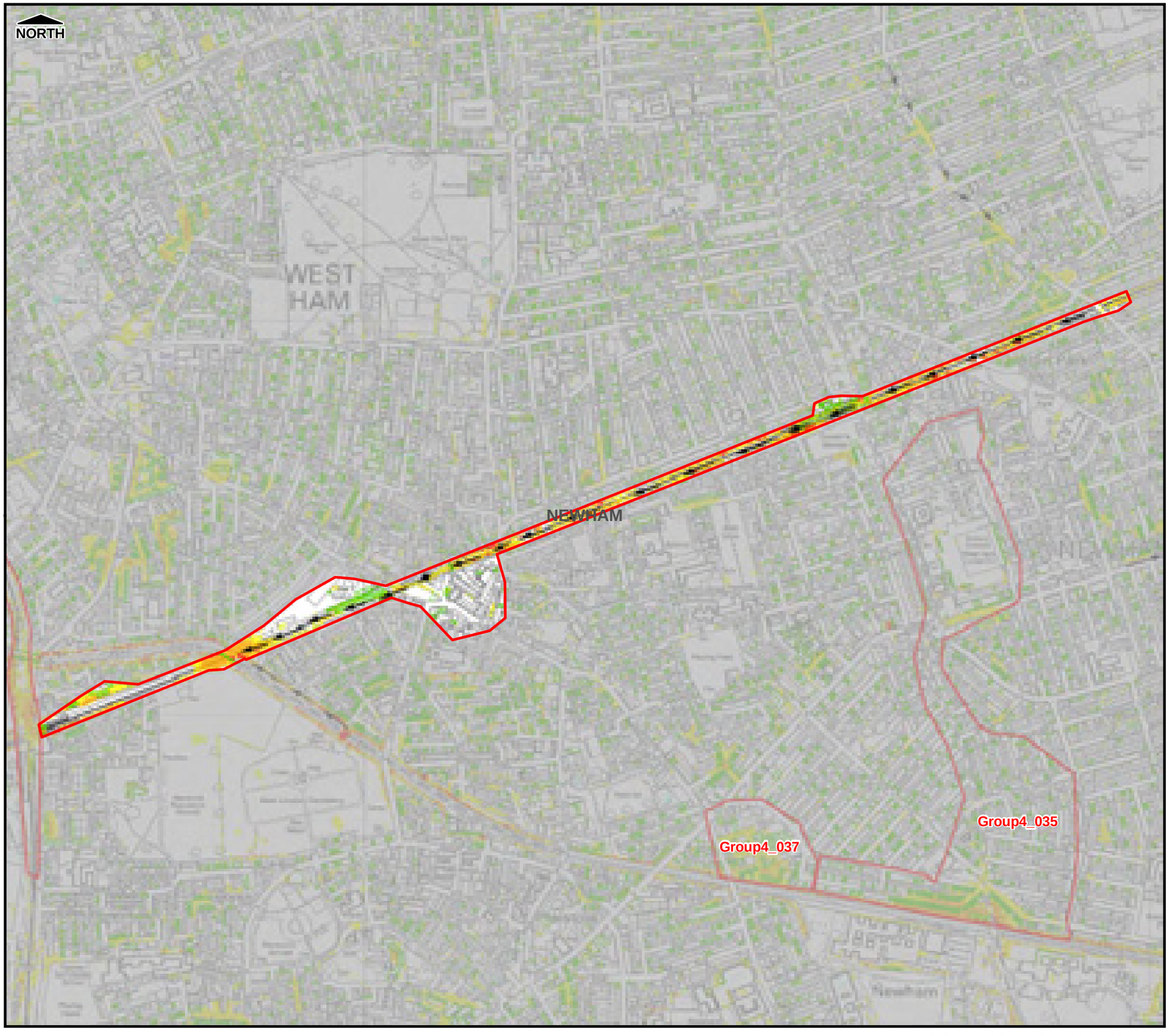
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA050.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:10,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 040
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

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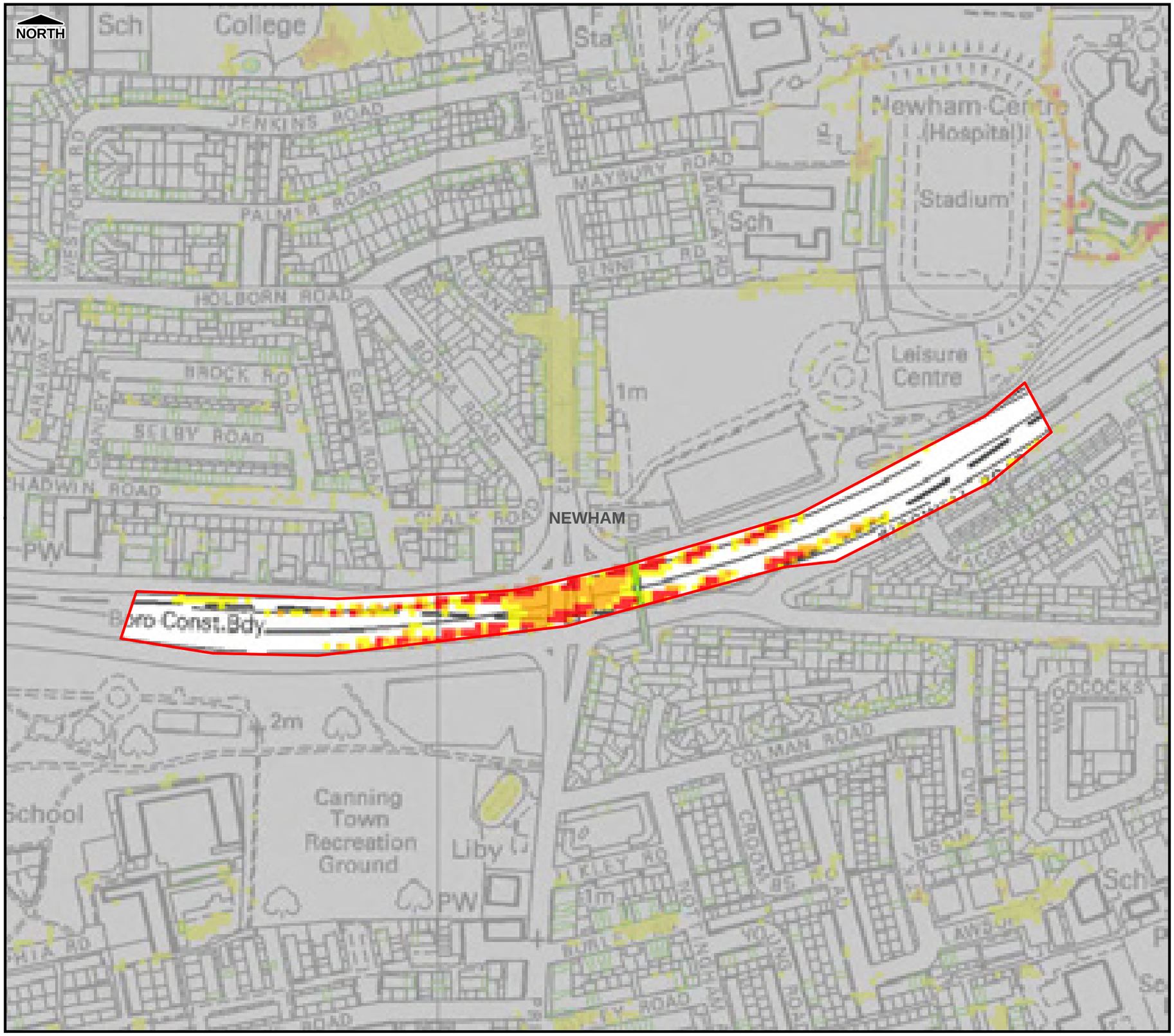
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA040.mxd



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 039
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants

CAPITA SYMONDS
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London
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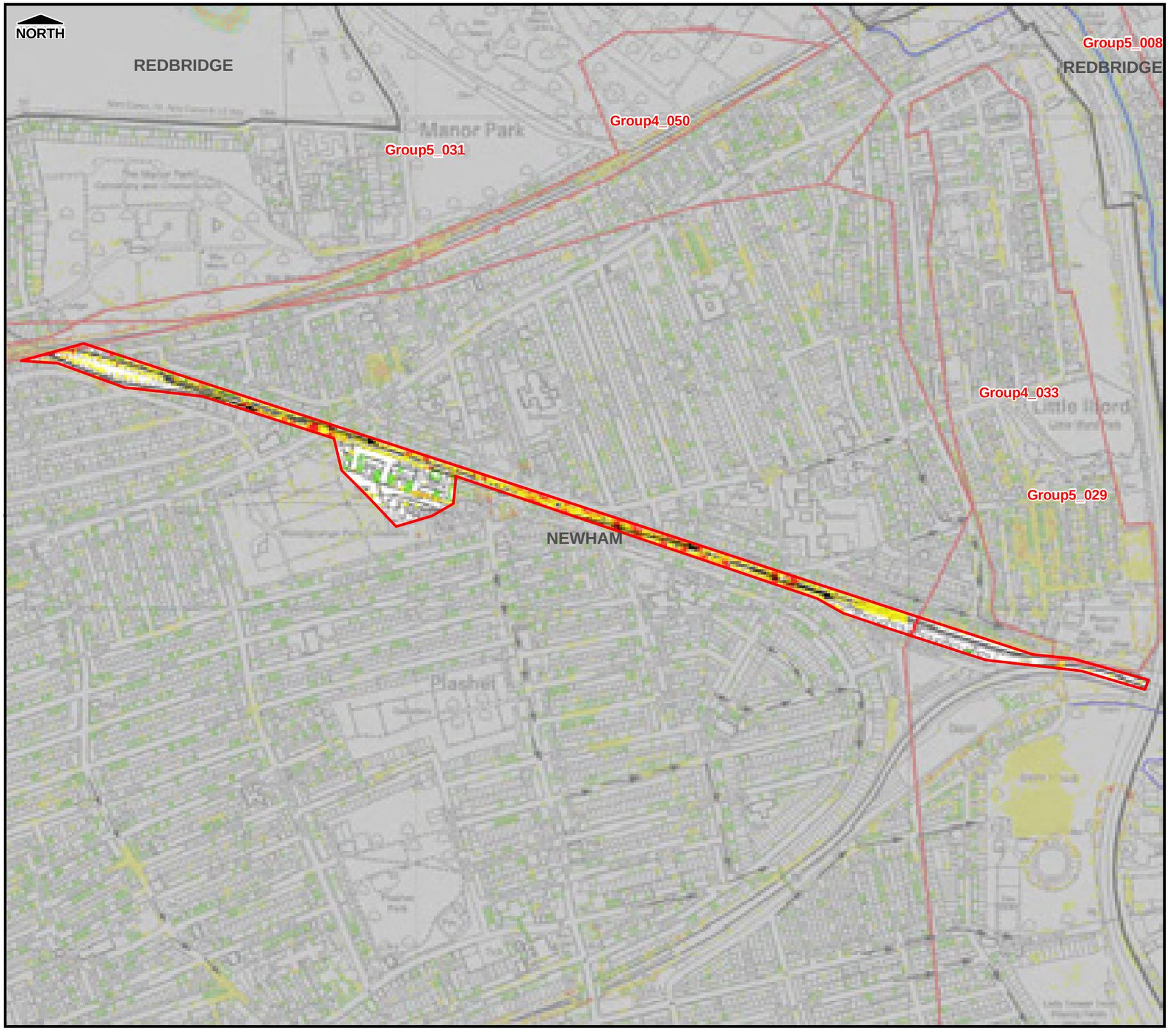
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA039.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:8,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 038
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA038.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:1,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 037
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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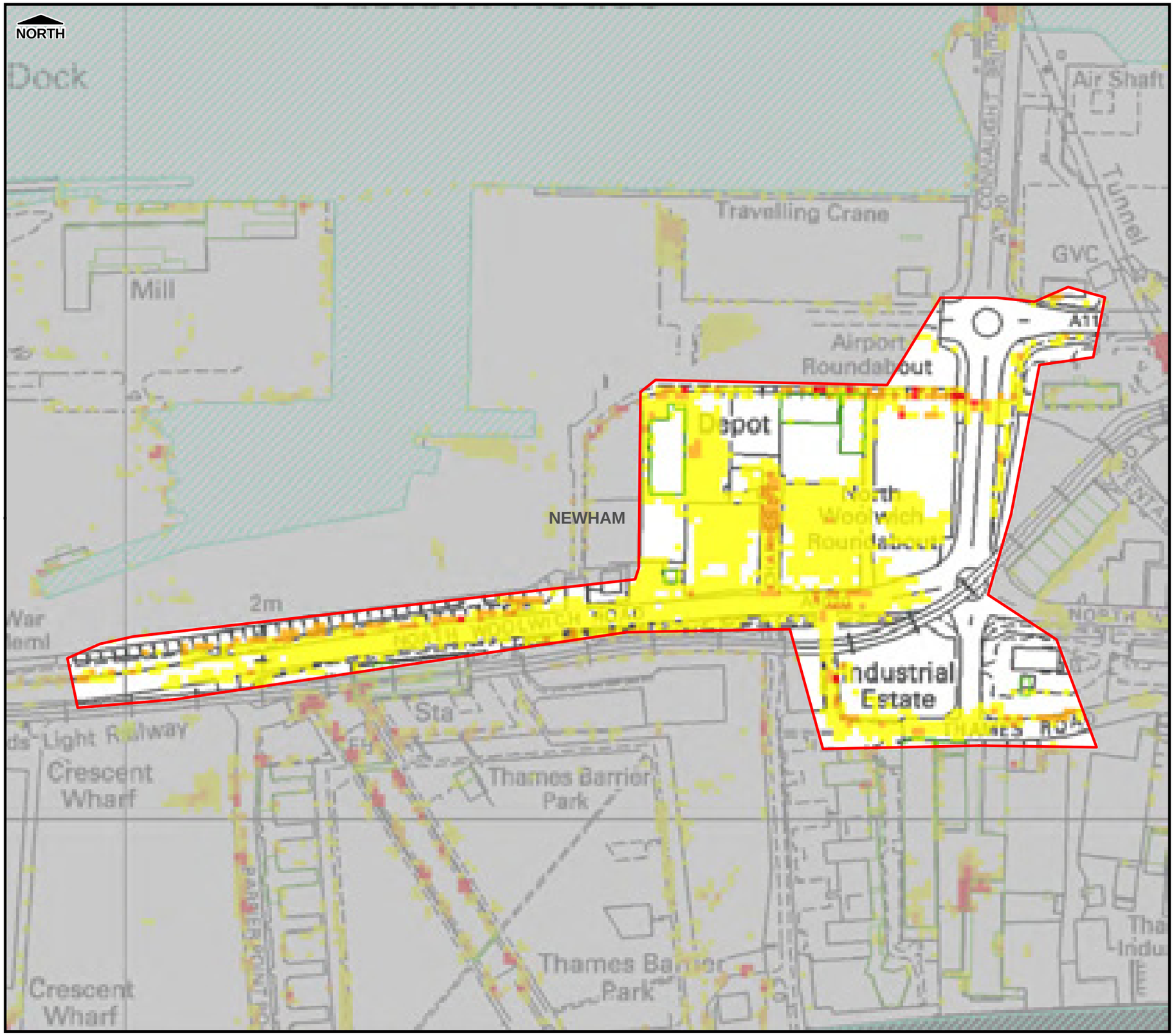
FIGURE 24

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA037.mxd



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 036
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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London
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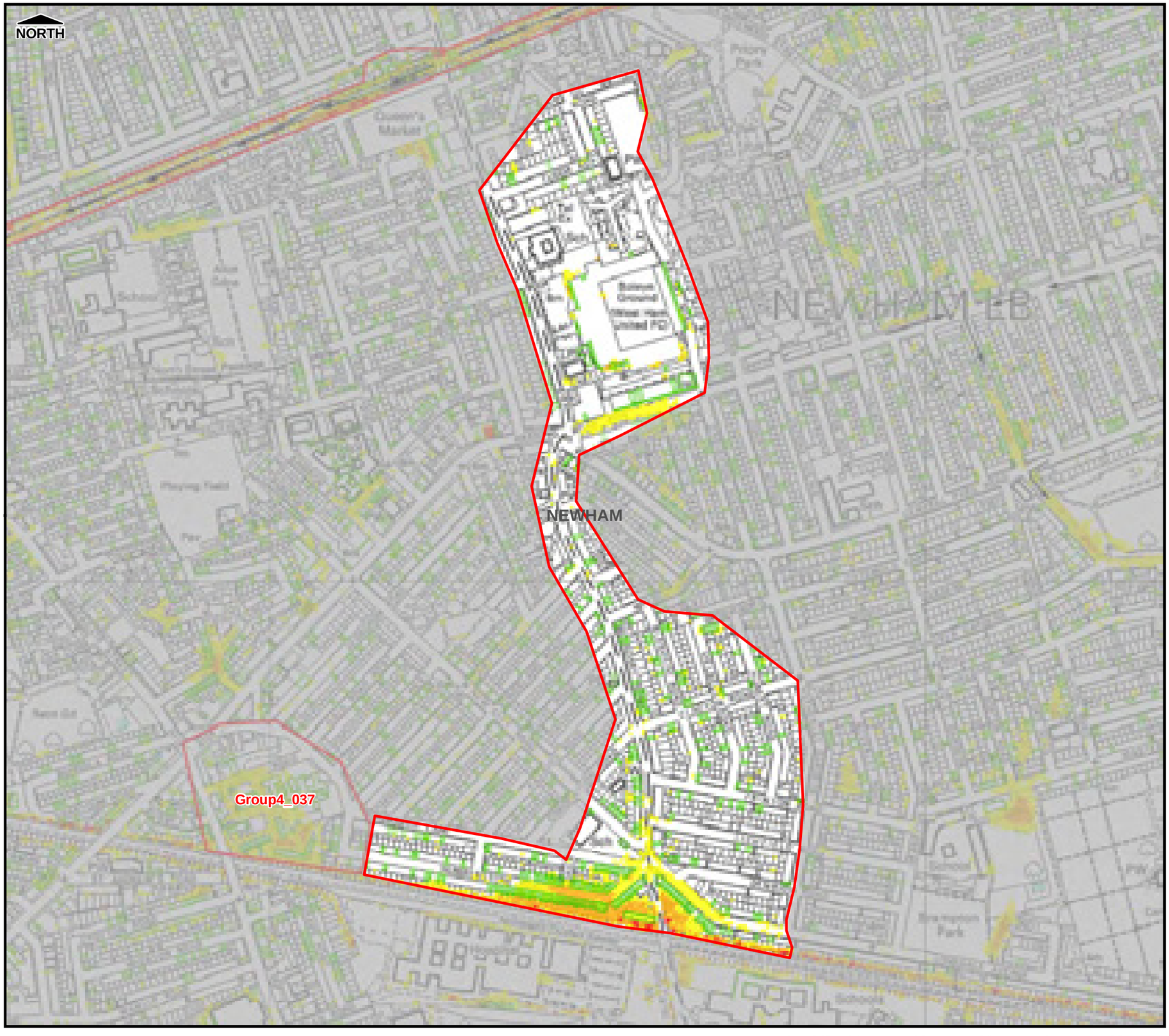
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group1\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA036.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:6,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 035
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

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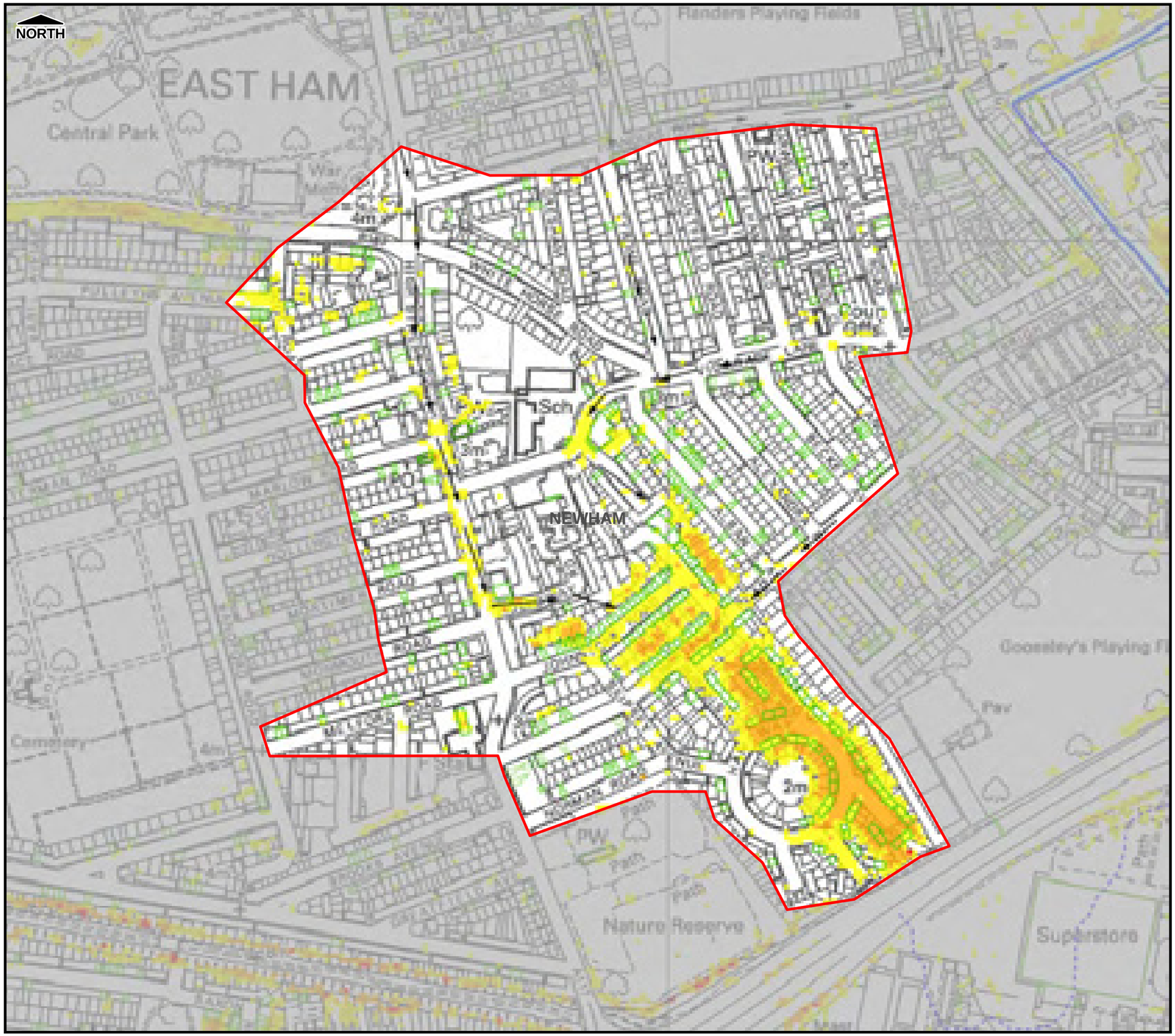
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA035.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:4,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 034
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA034.mxd

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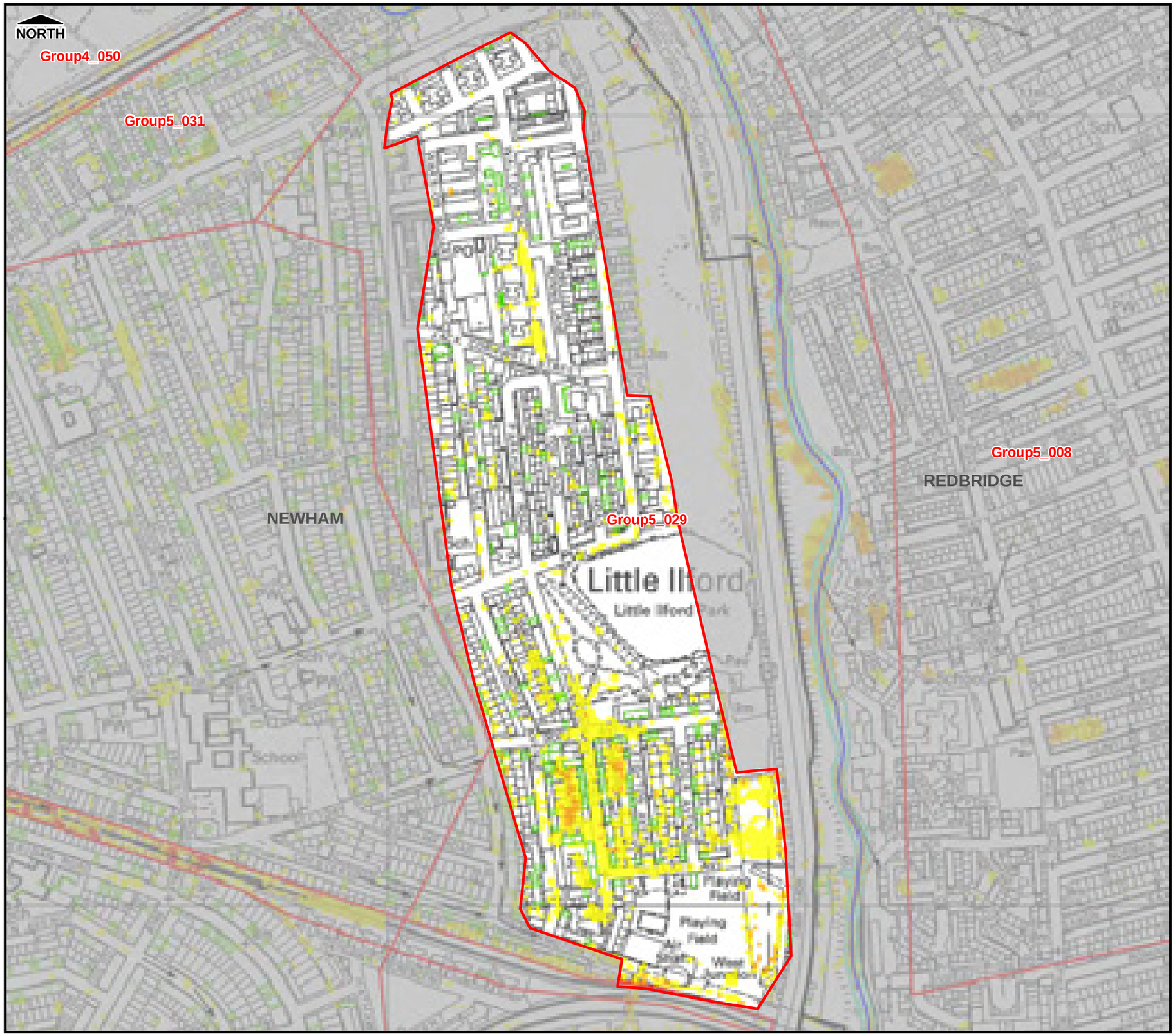

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

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   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:5,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 033
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

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FIGURE 24

Filepath: L:\Environment\zwetCS\46913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA033.mxd

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Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:2,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 032
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
CAPITA SYMONDS
Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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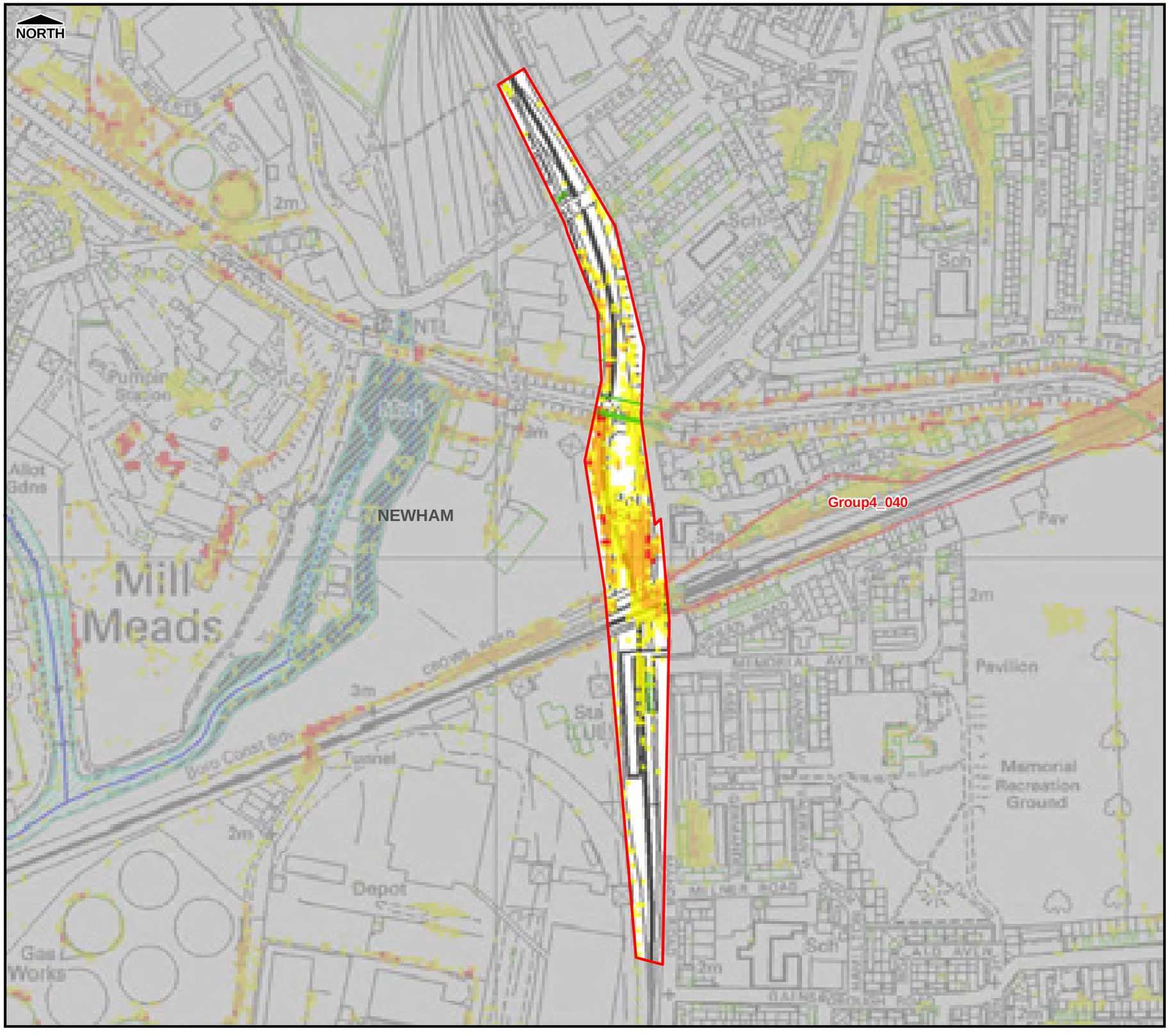
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA032.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Flooded Building (With Basement)
- Critical Drainage Area
- Permanent Water Bodies
- Culverted Watercourse (Main River)
- Flow Direction
- Flooded Building (Without Basement)

Critical Flood Hazard

- Caution (very low hazard)
- Moderate (danger for some)
- Significant (danger for most)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:4,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 031
Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
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52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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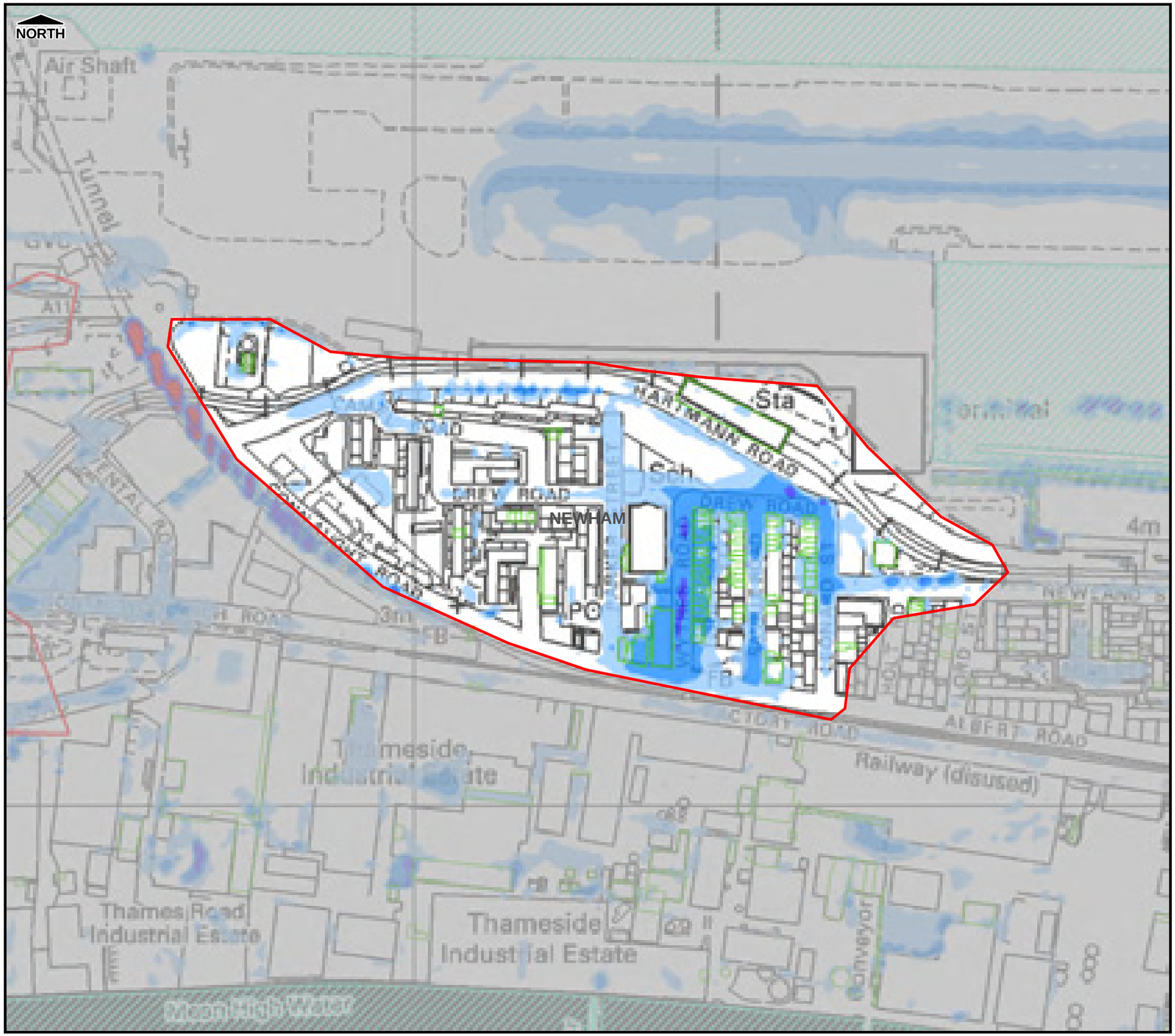
FIGURE 24

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig24_Hazard_100_CDA031.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 053
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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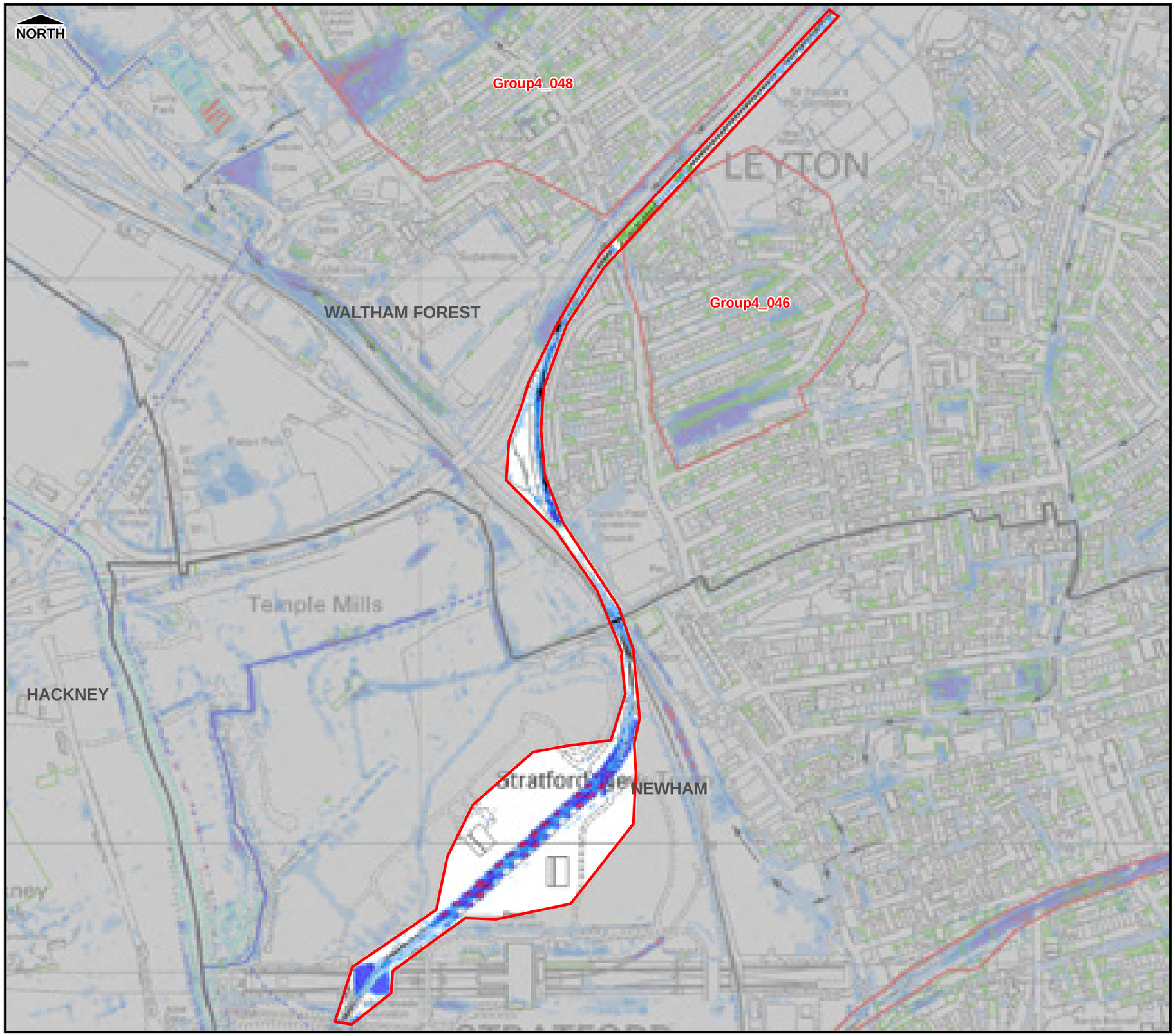
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA053.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:7,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 051
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
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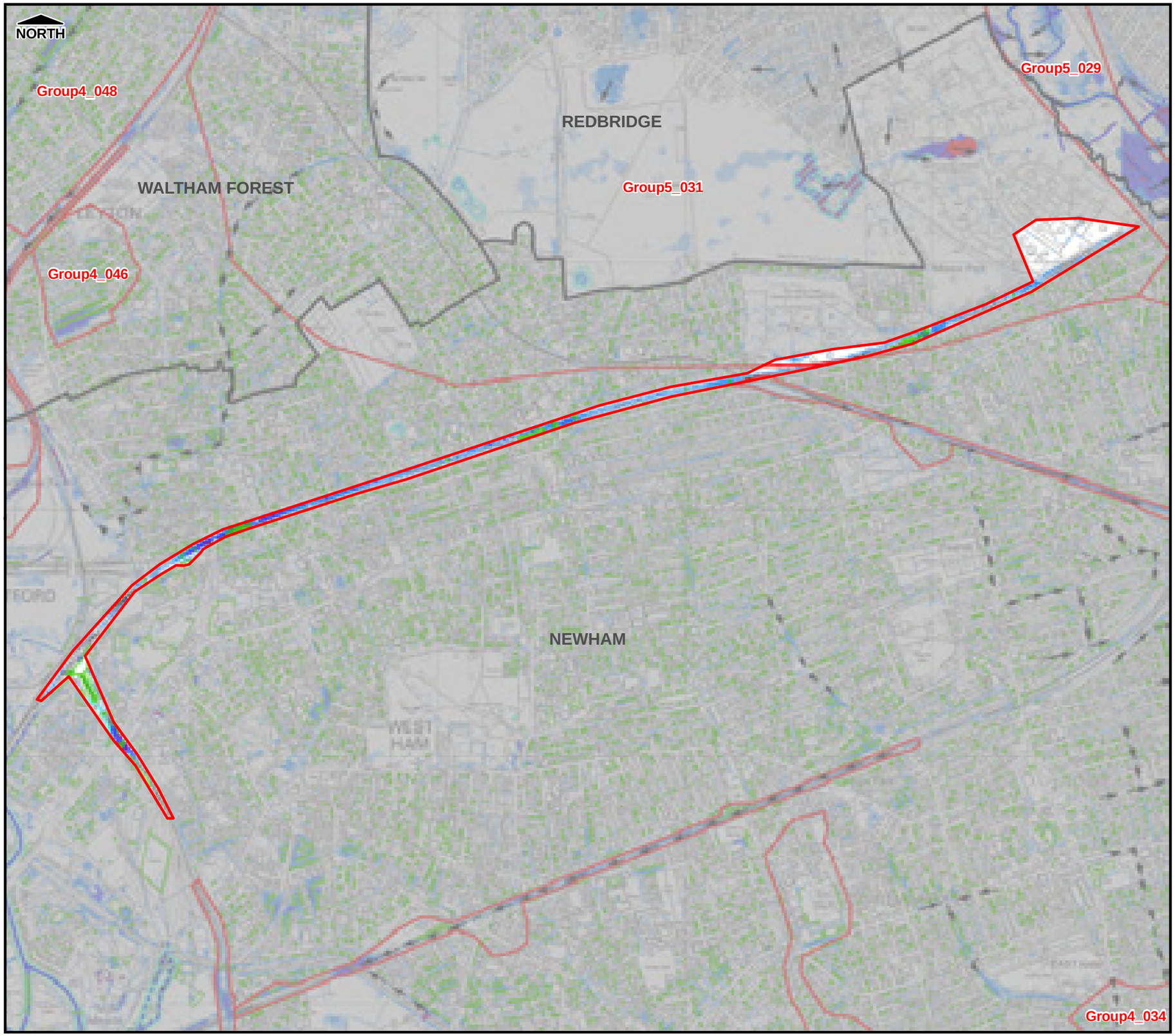
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA051.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:16,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 050
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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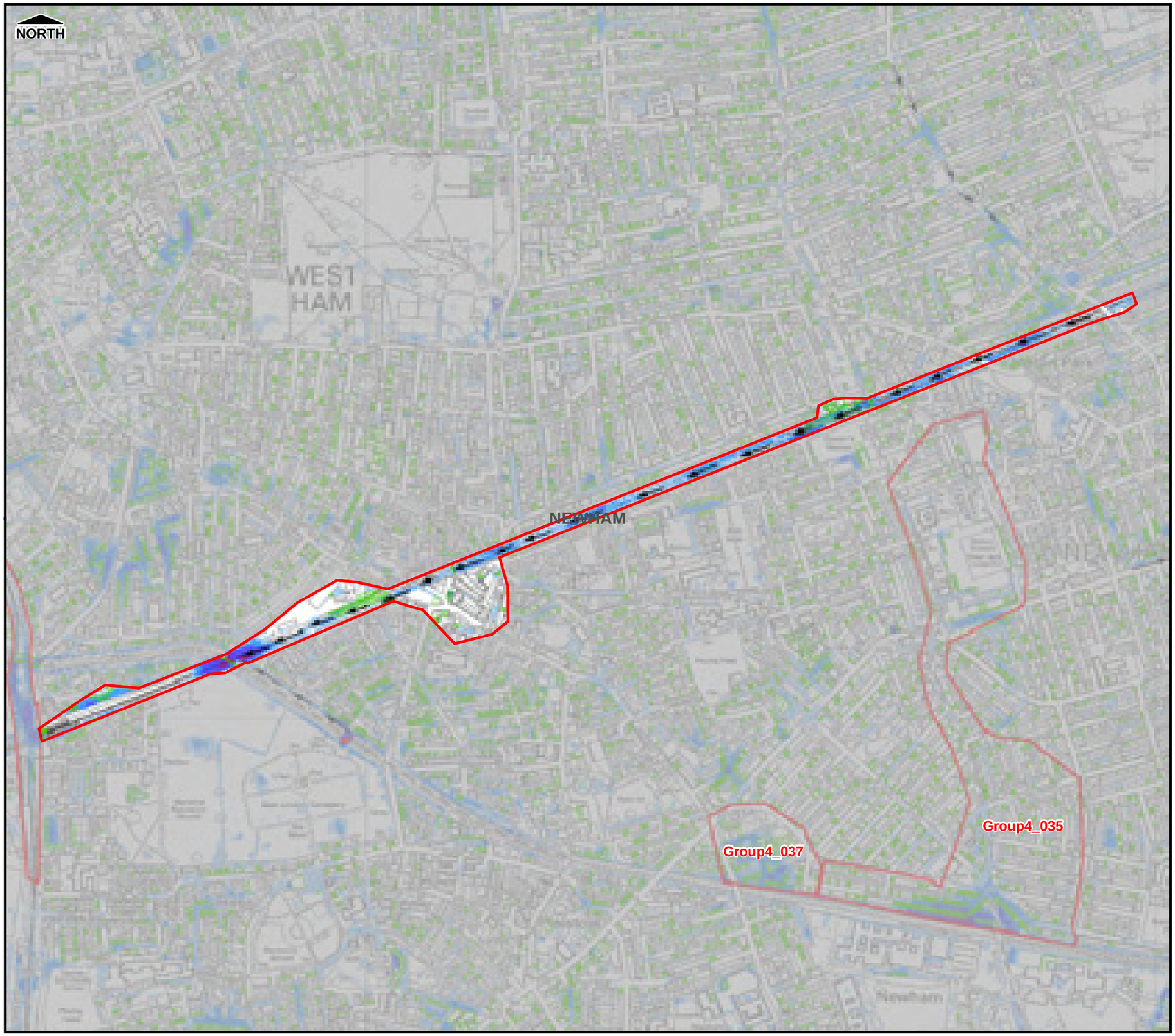
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA050.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:10,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 040
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
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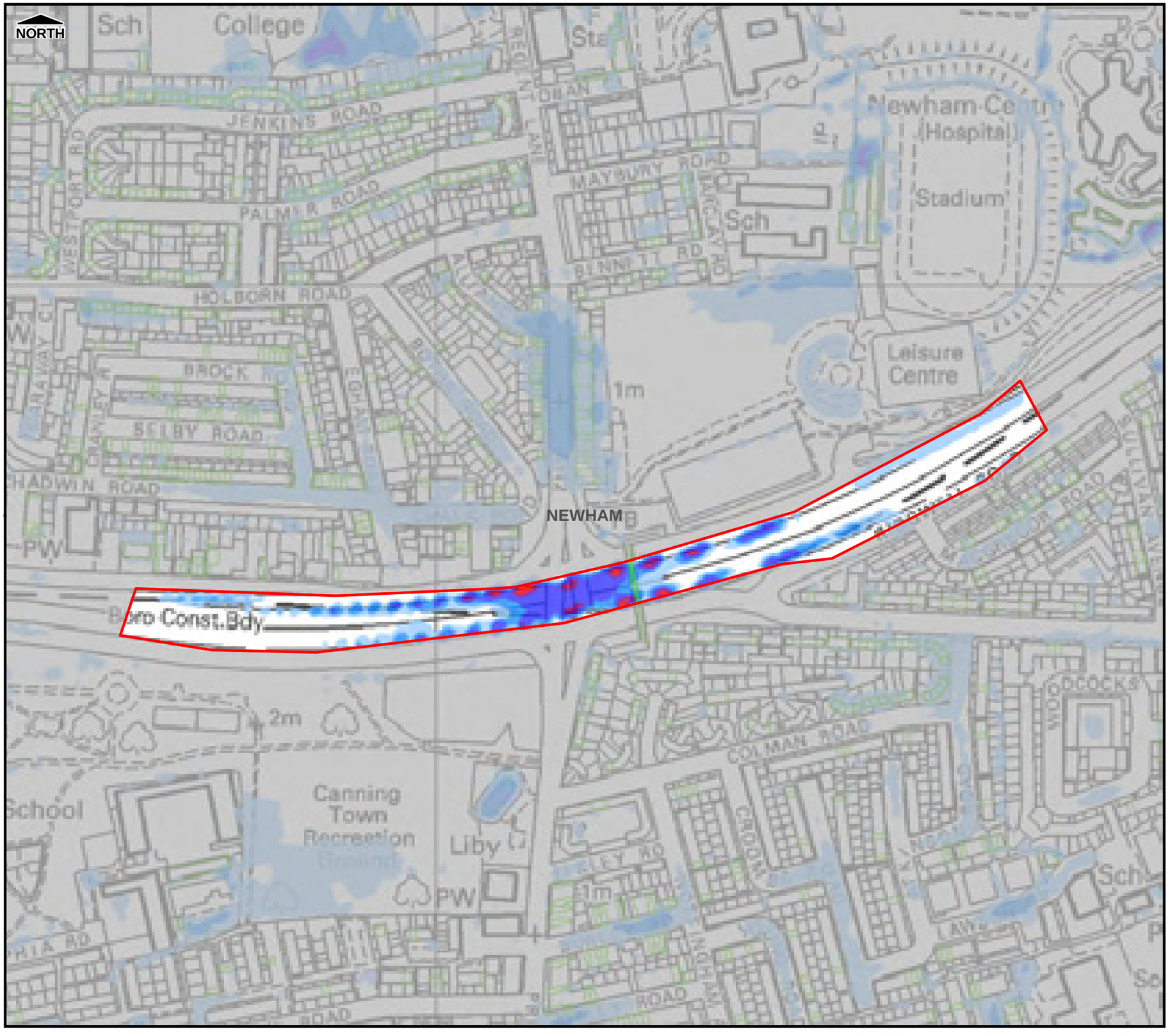
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA040.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 039
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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FIGURE 23

Filepath: L:\Environment\wat\CS\046913_DrainLondon_Tier2\Group2\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA039.mxd

0 0.05 0.1 0.2 0.3 0.4 0.5
Kilometres

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:8,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 038
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
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Belgravia,
London
SW1W 0AU

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FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA038.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
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London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:1,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 037
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
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London
SW1W 0AU

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FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA037.mxd

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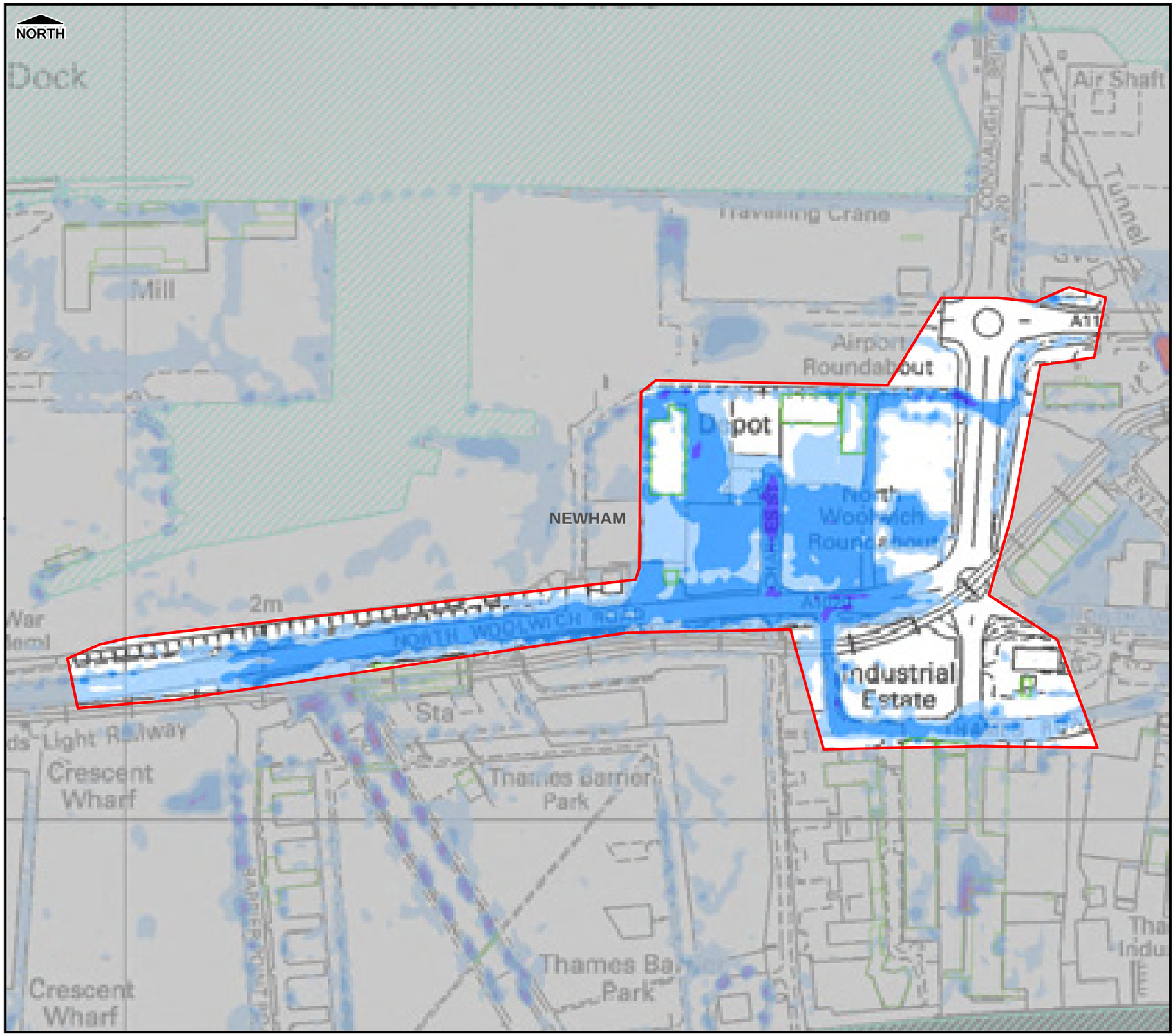

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:3,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 036
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
CAPITA SYMONDS
Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
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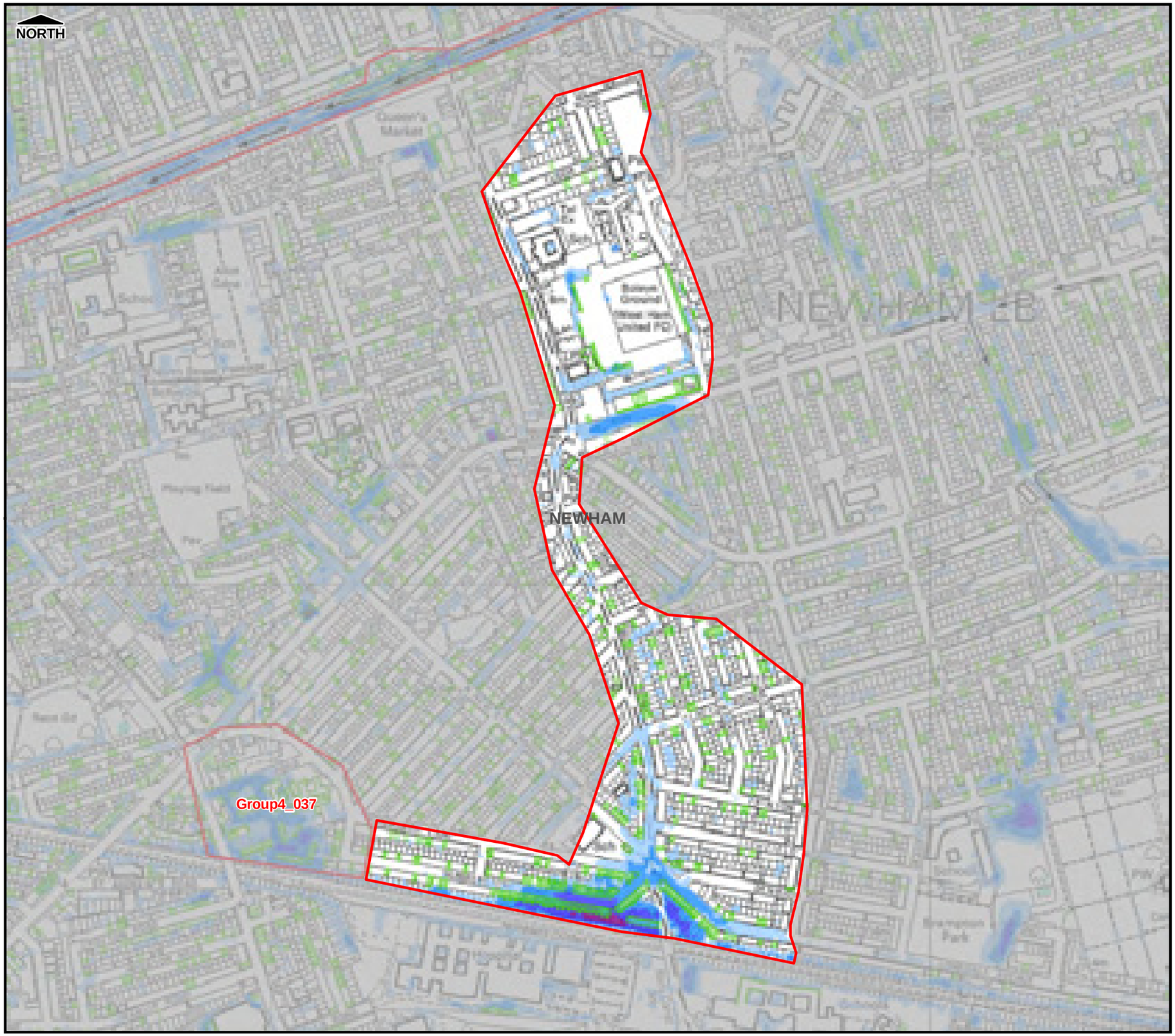
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA036.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:6,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 035
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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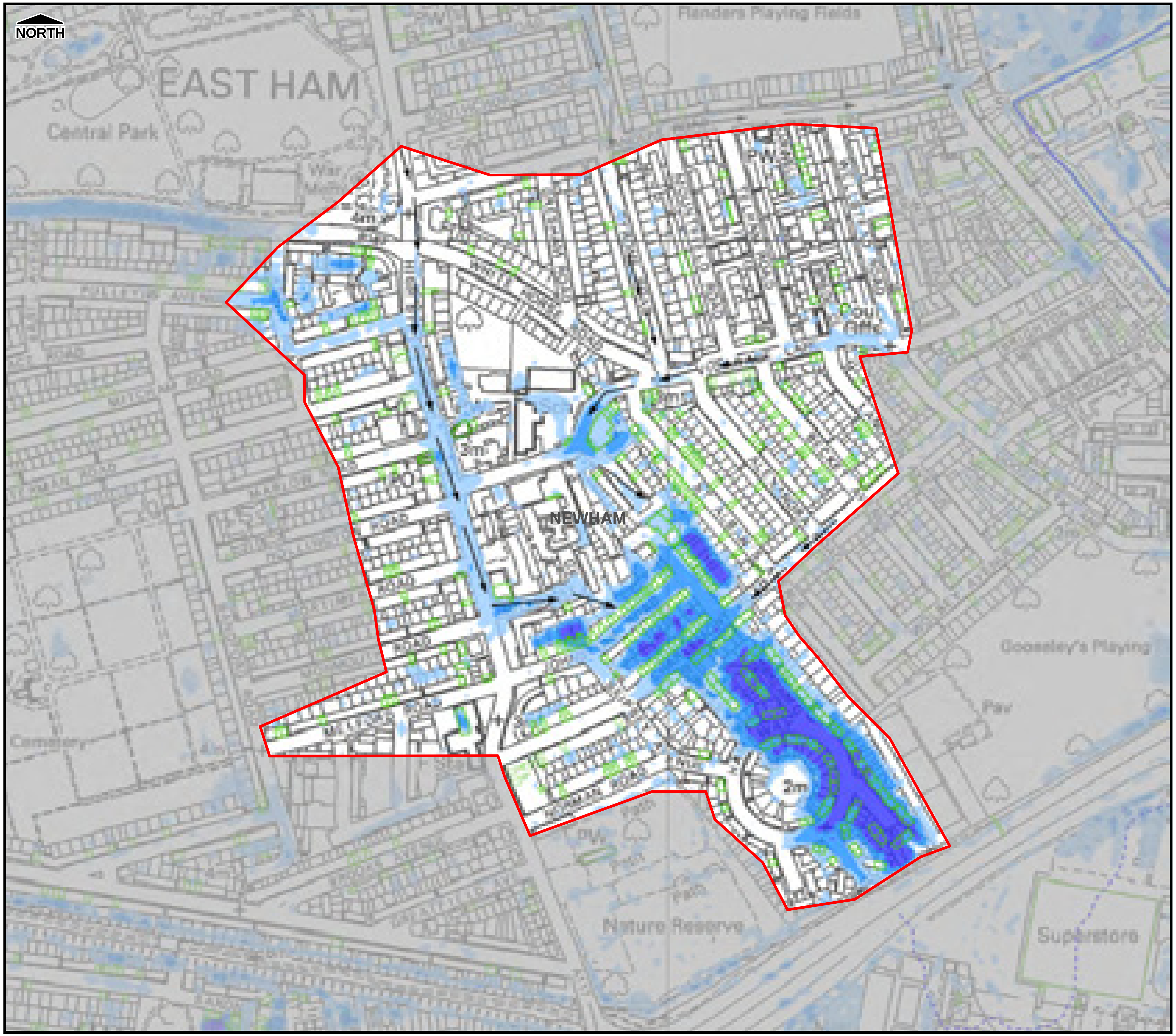
FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA035.mxd



0 0.025 0.05 0.1 0.15 0.2 Kilometres

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:4,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 034
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants

Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA034.mxd

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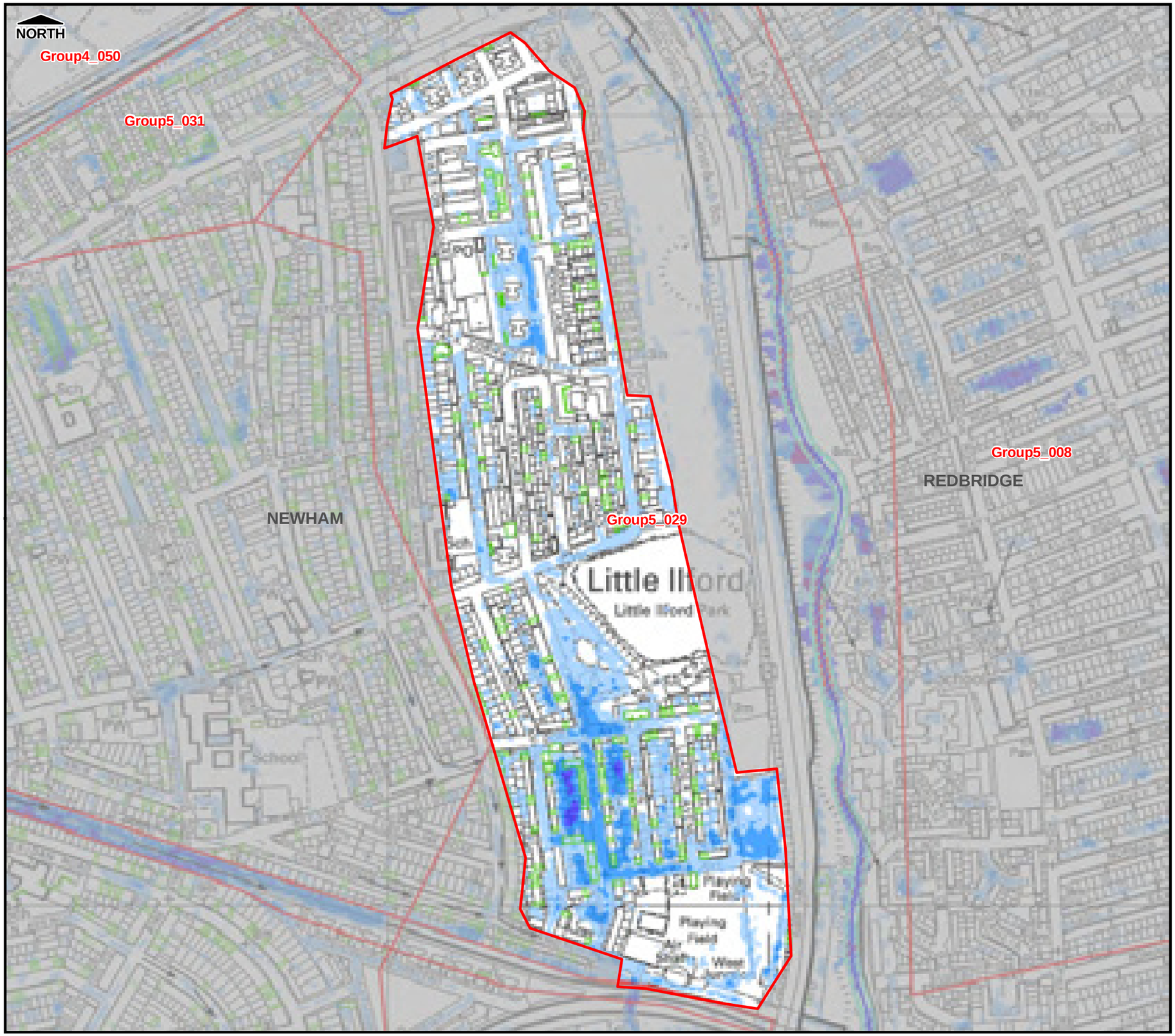

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:5,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 033
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
CAPITA SYMONDS
Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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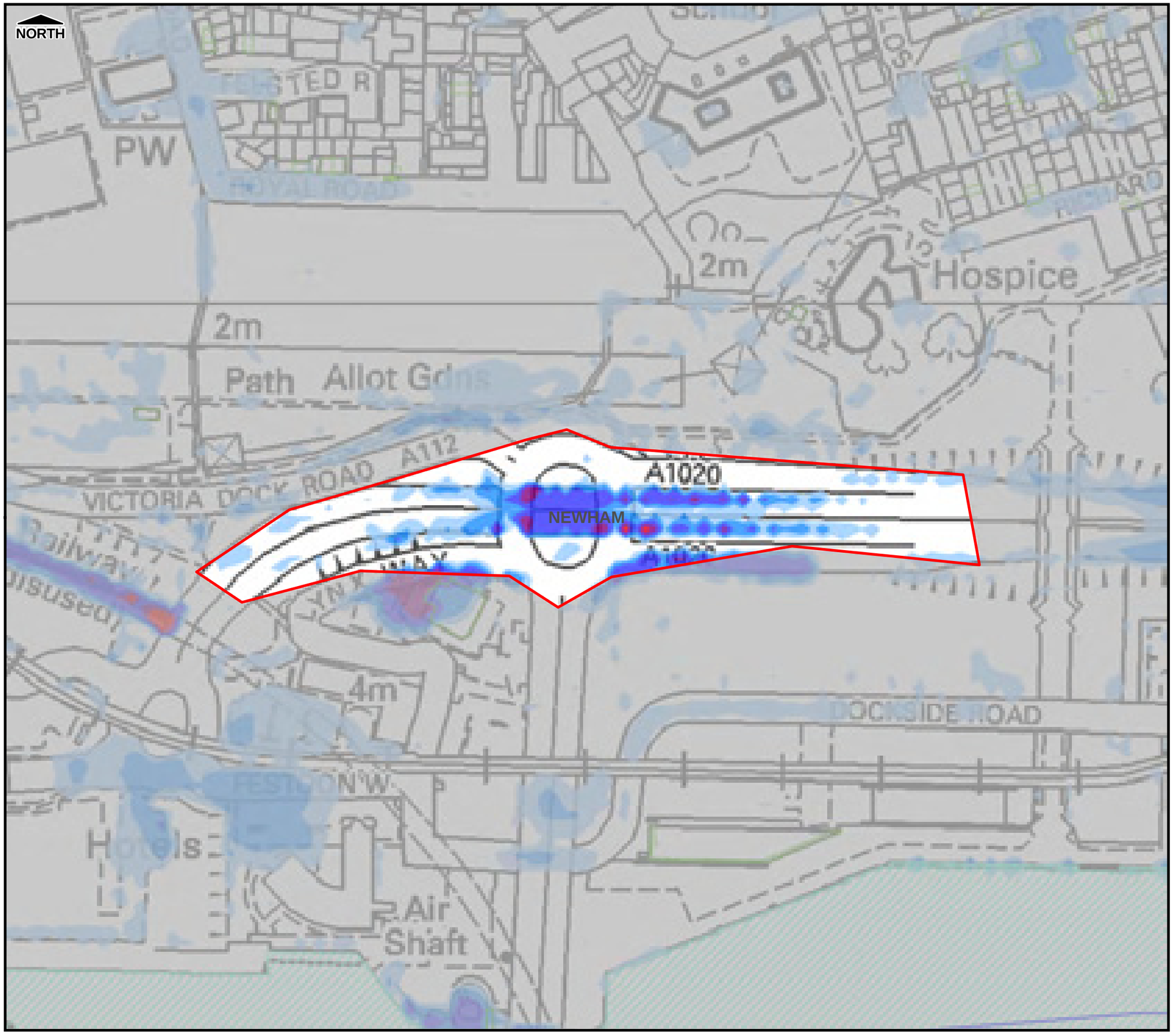
FIGURE 23

Filepath: L:\Environment\zwetCS\046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA033.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:2,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 032
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
CAPITA SYMONDS
Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

Drain London Programme Board Members

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FIGURE 23

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA032.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

Group4_040

NEWHAM

Mill Meads

Depot

Pavilion

Memorial Recreation Ground

Gas Works

0 0.025 0.05 0.1 0.15 0.2
Kilometres

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Flow Direction
- Critical Drainage Area
- Flooded Building (With Basement)
- Flooded Building (Without Basement)

Flood Depth (m)

- < 0.1m
- 0.1m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1.0m
- 1.0m - 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:4,000	09/05/2011	D.HUGHES	S.IP

Critical Drainage Area 031
Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
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Belgravia,
London
SW1W 0AU

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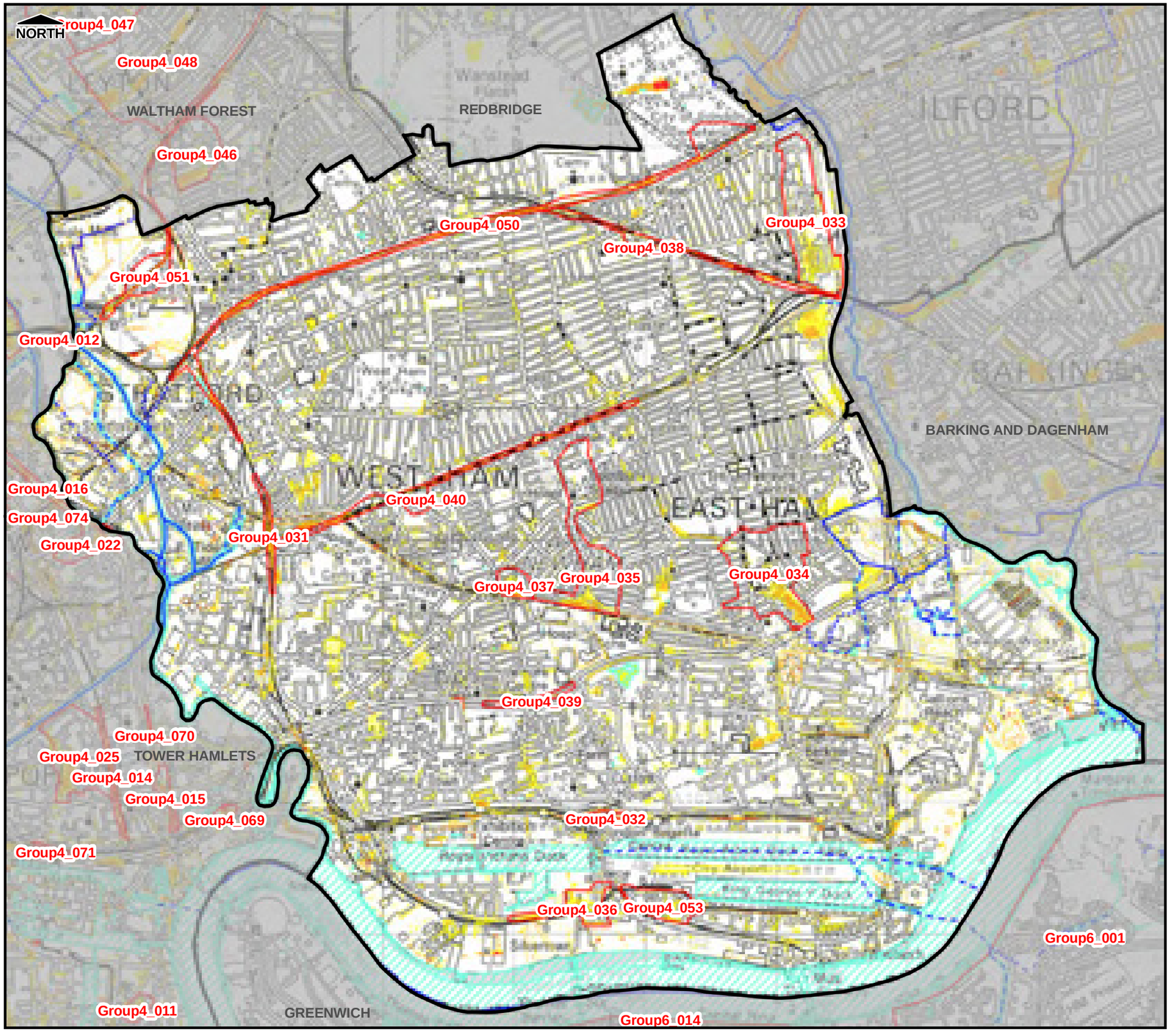
FIGURE 23

Filepath: L:\Environment\zwetCS\046913_DrainLondon_Tier2\Group4\ARC\mxds\SWMP_GP4_Newham_Fig23_Depth_100_CDA031.mxd



Filepath: L:\Environment\zwetCS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig22_Hazard_200.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Critical Drainage Area
- Main River
- Culverted Watercourse
- Ordinary Watercourse
- Permanent Water Bodies
- Flow Direction

Critical Flood Hazard

- Caution (very low hazard)
- Significant (danger for most)
- Moderate (danger for some)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	13/07/2011	D.HUGHES	S.IP

Surface Water Flood Hazard Rating
1 in 200 Chance of rainfall event occurring in any given year (0.5% AEP)

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52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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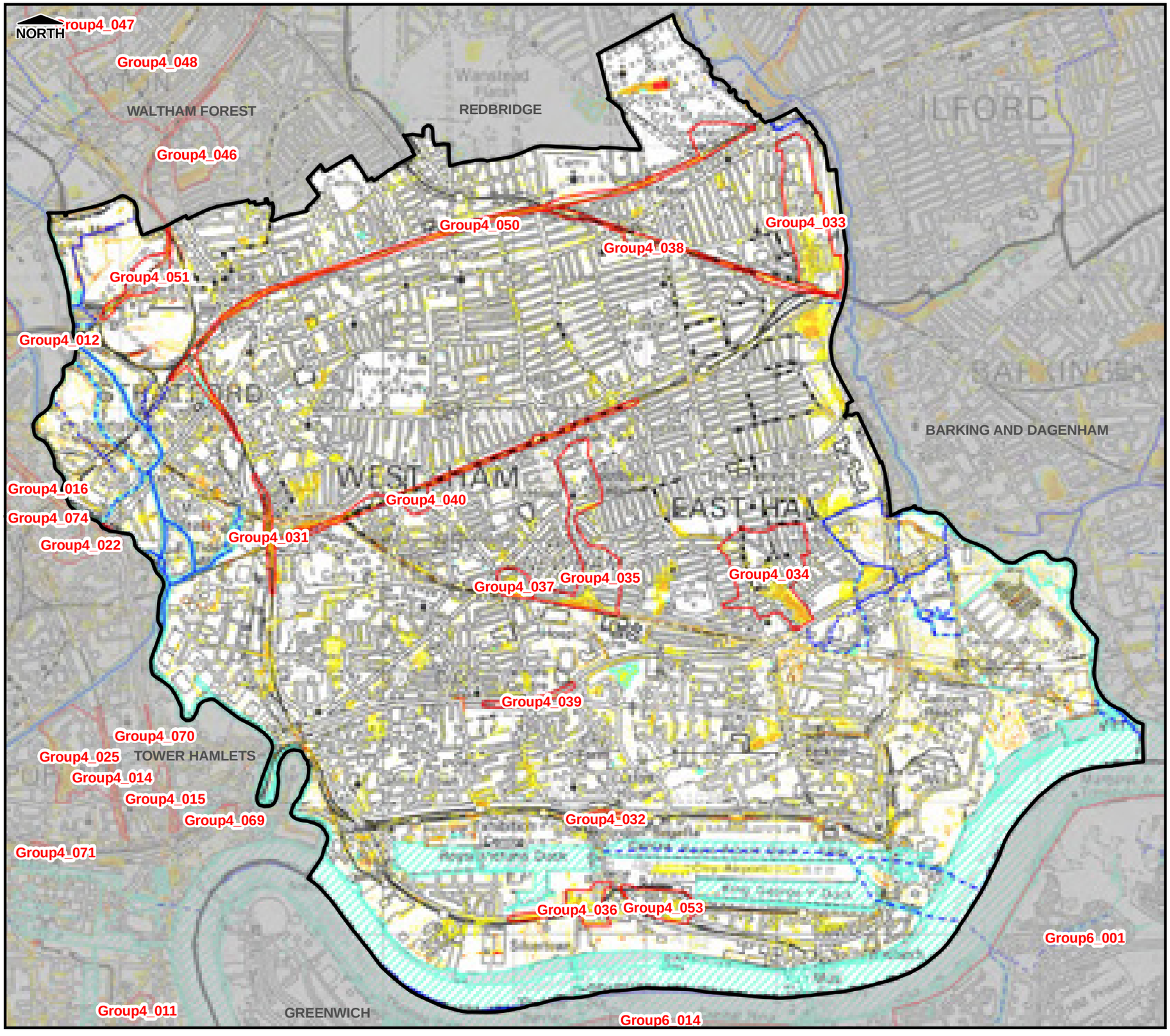
FIGURE 22



Filepath: L:\Environment\zwetCS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig21_Hazard_100CC.mxd

Legend

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

- Borough Administrative Boundary
- Critical Drainage Area
- Main River
- Culverted Watercourse
- Ordinary Watercourse
- Permanent Water Bodies
- Flow Direction

Critical Flood Hazard

- Caution (very low hazard)
- Significant (danger for most)
- Moderate (danger for some)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	13/07/2011	D.HUGHES	S.IP

Surface Water Flood Hazard Rating
1 in 100 plus climate change Chance of rainfall event occurring in any given year (1% AEP + CC)

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52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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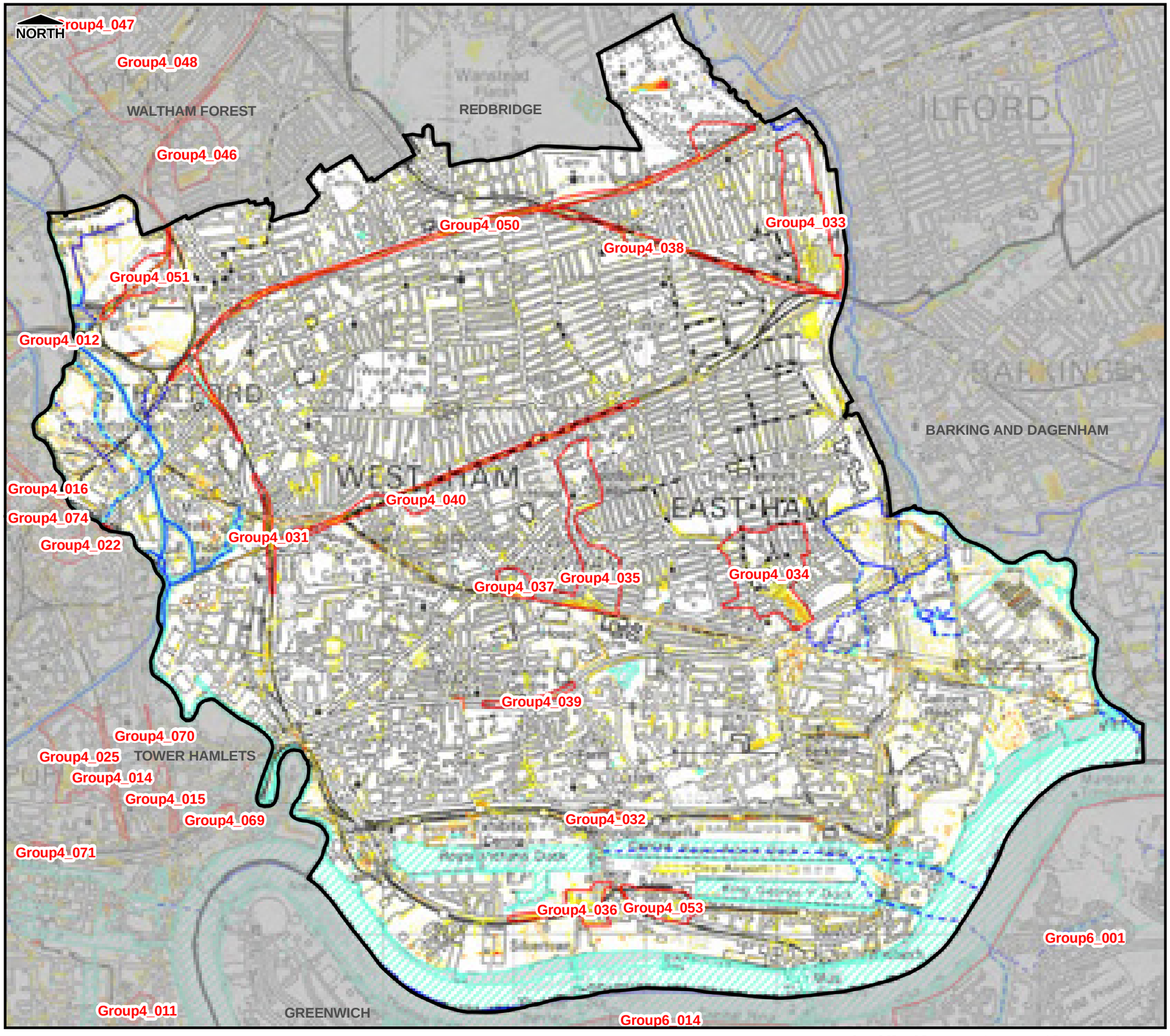
FIGURE 21



Filepath: L:\Environment\zwetCS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig20_Hazard_100.mxd

Legend

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

- Borough Administrative Boundary
- Critical Drainage Area
- Main River
- Culverted Watercourse
- Ordinary Watercourse
- Permanent Water Bodies
- Flow Direction

Critical Flood Hazard

- Caution (very low hazard)
- Significant (danger for most)
- Moderate (danger for some)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
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   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	13/07/2011	D.HUGHES	S.IP

Surface Water Flood Hazard Rating
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

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Belgravia,
London
SW1W 0AU

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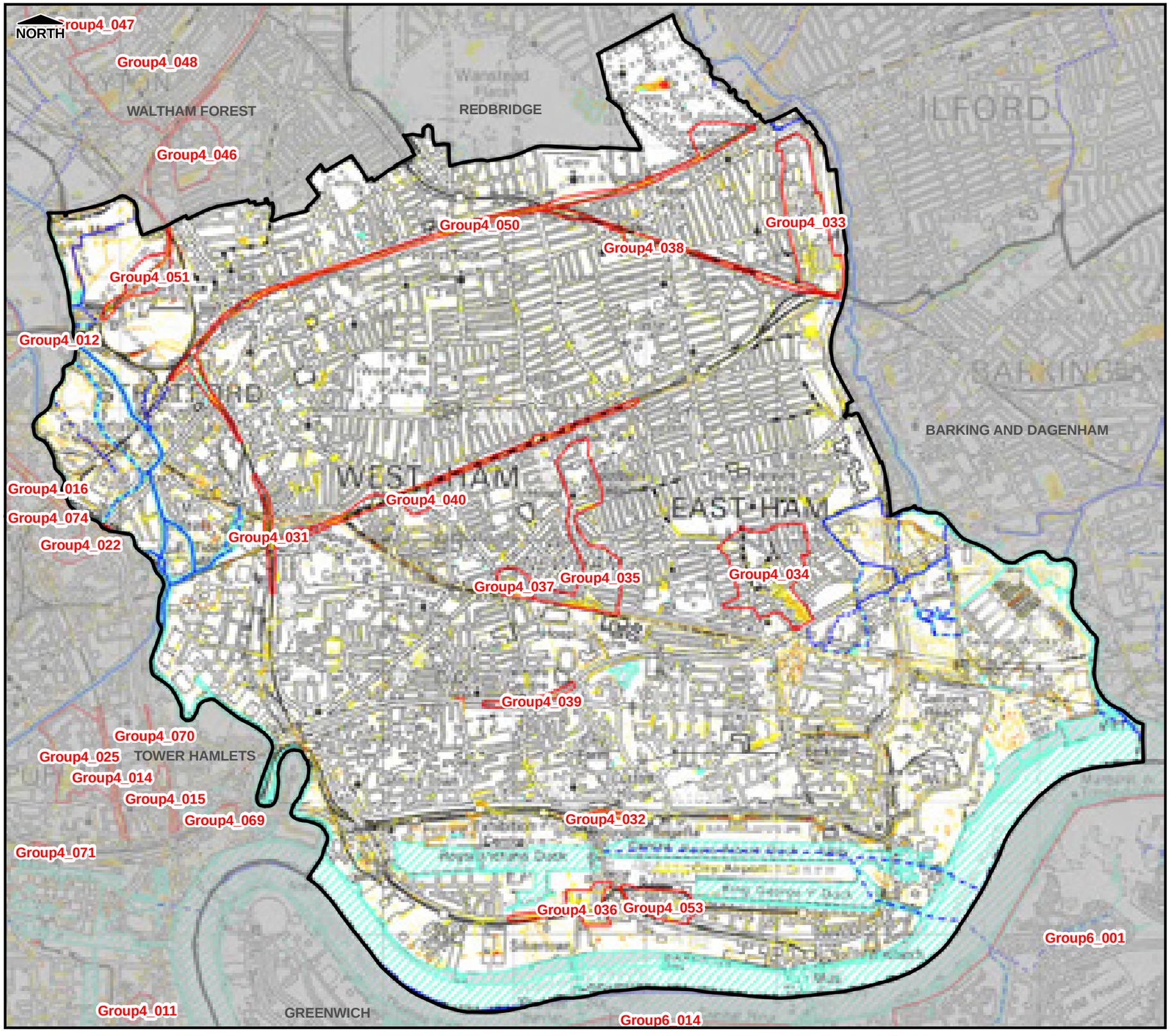
FIGURE 20



Legend

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

- Borough Administrative Boundary
- Critical Drainage Area
- Main River
- Culverted Watercourse
- Ordinary Watercourse
- Permanent Water Bodies
- Flow Direction

Critical Flood Hazard

- Caution (very low hazard)
- Significant (danger for most)
- Moderate (danger for some)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
3. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
4. Degree of flood hazard can be interpreted as follows:
   - Caution: Flood zone with shallow flowing water or deep standing water
   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	13/07/2011	D.HUGHES	S.IP

Surface Water Flood Hazard Rating
1 in 75 Chance of rainfall event occurring in any given year (1.33% AEP)

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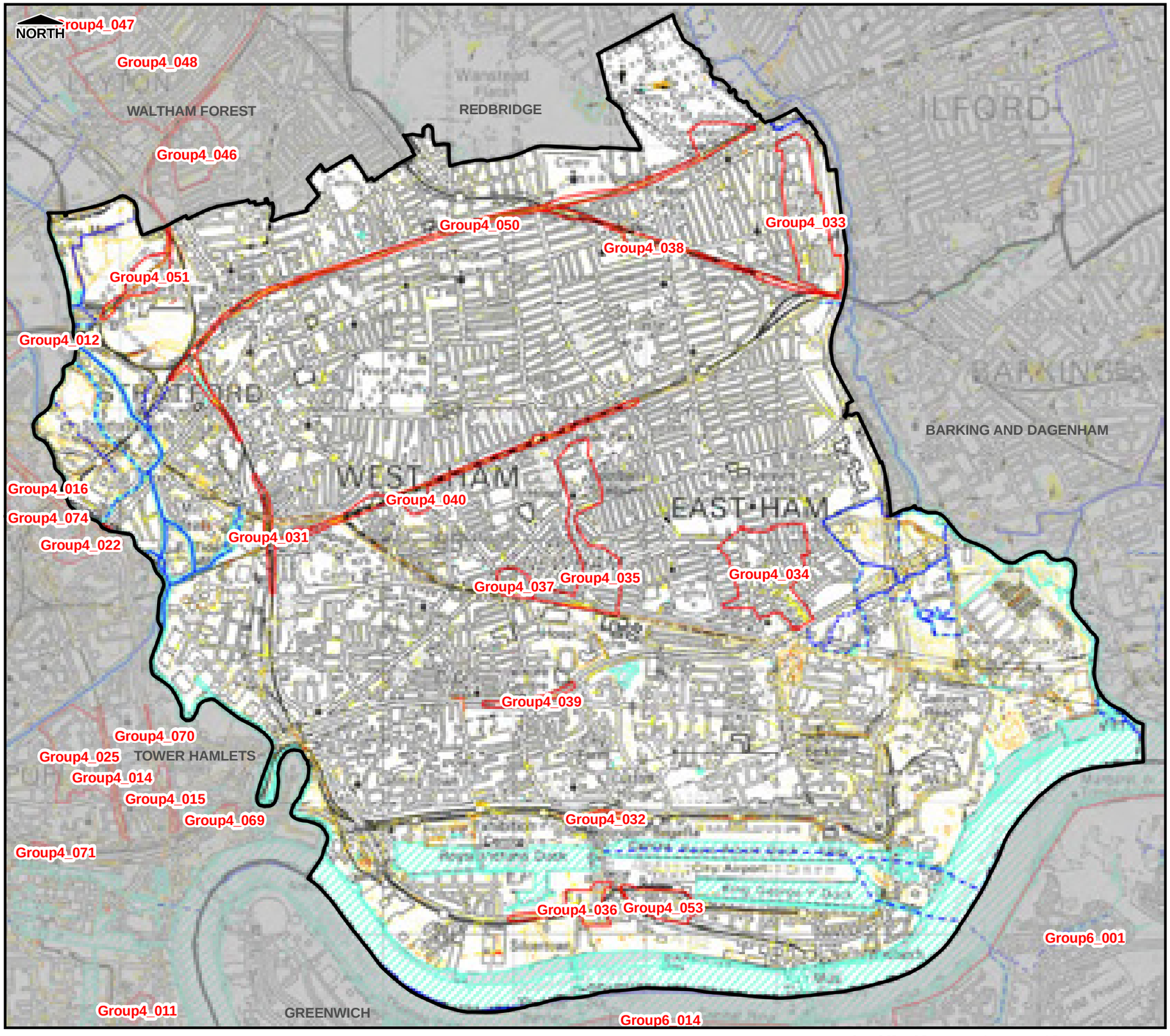
FIGURE 19

Filepath: L:\Environment\zwetCS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig19_Hazard_75.mxd



Legend

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

- Borough Administrative Boundary
- Critical Drainage Area
- Main River
- Culverted Watercourse
- Ordinary Watercourse
- Permanent Water Bodies
- Flow Direction

Critical Flood Hazard

- Caution (very low hazard)
- Significant (danger for most)
- Moderate (danger for some)
- Extreme (danger for all)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to Section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood / hazard extents shown.
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   - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
   - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
   - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	13/07/2011	D.HUGHES	S.IP

Surface Water Flood Hazard Rating
1 in 30 Chance of rainfall event occurring in any given year (3.33% AEP)

Consultants
Capita Symonds
Level Seven,
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London
SW1W 0AU

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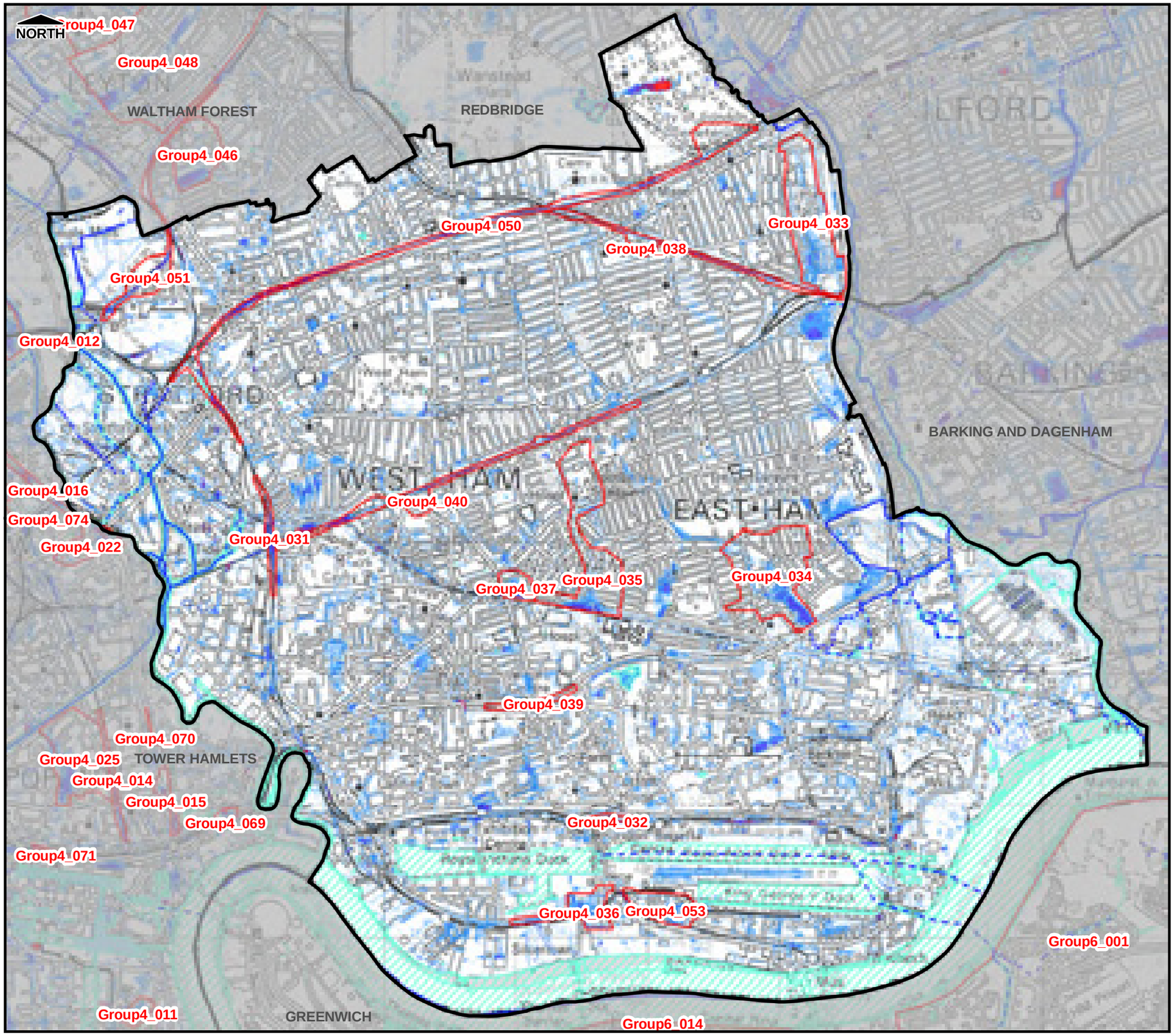
FIGURE 18

Filepath: L:\Environment\zwetCS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig18_Hazard_30.mxd



Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig17_Depth_200.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Critical Drainage Area
- Permanent Water Bodies

Flood Depth

< 0.1m	0.5m to 1.0m
0.1m to 0.25m	1.0m to 1.5m
0.25m to 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	12/07/2011	D.HUGHES	S.IP

Surface Water Depth (m)
1 in 200 Chance of rainfall event occurring in any given year (0.5% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
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Belgravia,
London
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FIGURE 17

NORTH

Group4_047
Group4_048
Group4_046
Group4_050
Group4_033
Group4_038
Group4_051
Group4_012
Group4_016
Group4_074
Group4_022
Group4_031
Group4_040
Group4_037
Group4_035
Group4_034
Group4_039
Group4_070
Group4_025
Group4_014
Group4_015
Group4_069
Group4_032
Group4_071
Group4_036
Group4_053
Group6_001
Group4_011
Group6_014

WALTHAM FOREST
REDBRIDGE
BARKING AND DAGENHAM
TOWER HAMLETS
GREENWICH

0 0.25 0.5 1 1.5 2
Kilometres

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Critical Drainage Area
- Permanent Water Bodies

Flood Depth

< 0.1m	0.5m to 1.0m
0.1m to 0.25m	1.0m to 1.5m
0.25m to 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	12/07/2011	D.HUGHES	S.IP

Surface Water Depth (m)
1 in 100 plus climate change Chance of rainfall event occurring in any given year (1% AEP + CC)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
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FIGURE 16

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig16_Depth_100CC.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

NORTH

Group4_047
Group4_048
WALTHAM FOREST
REDBRIDGE
Group4_046
Group4_050
Group4_033
Group4_038
Group4_051
Group4_012
BARKING AND DAGENHAM
Group4_016
Group4_074
Group4_040
Group4_031
Group4_022
Group4_037
Group4_035
Group4_034
Group4_039
Group4_070
Group4_025
TOWER HAMLETS
Group4_014
Group4_015
Group4_069
Group4_032
Group4_071
Group4_036
Group4_053
Group6_001
Group4_011
GREENWICH
Group6_014

0 0.25 0.5 1 1.5 2 Kilometres

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Critical Drainage Area
- Permanent Water Bodies

Flood Depth

- < 0.1m
- 0.1m to 0.25m
- 0.25m to 0.5m
- 0.5m to 1.0m
- 1.0m to 1.5m
- > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	12/07/2011	D.HUGHES	S.IP

Surface Water Depth (m)
1 in 100 Chance of rainfall event occurring in any given year (1% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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FIGURE 15

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig15_Depth_100.mxd

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THE PURPOSE INTENDED

NORTH

Group4_047
Group4_048
WALTHAM FOREST
REDBRIDGE
Group4_046
Group4_050
Group4_033
Group4_038
Group4_051
Group4_012
BARKING AND DAGENHAM
Group4_016
Group4_074
Group4_040
Group4_031
Group4_022
Group4_037
Group4_035
Group4_034
Group4_039
Group4_070
Group4_025
TOWER HAMLETS
Group4_014
Group4_015
Group4_069
Group4_032
Group4_071
Group4_036
Group4_053
Group6_001
Group4_011
GREENWICH
Group6_014

0 0.25 0.5 1 1.5 2
Kilometres

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Critical Drainage Area
- Permanent Water Bodies

Flood Depth

< 0.1m	0.5m to 1.0m
0.1m to 0.25m	1.0m to 1.5m
0.25m to 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	12/07/2011	D.HUGHES	S.IP

Surface Water Depth (m)
1 in 75 Chance of rainfall event occurring in any given year (1.33% AEP)

Consultants
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Capita Symonds
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London
SW1W 0AU

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FIGURE 14

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig14_Depth_75.mxd

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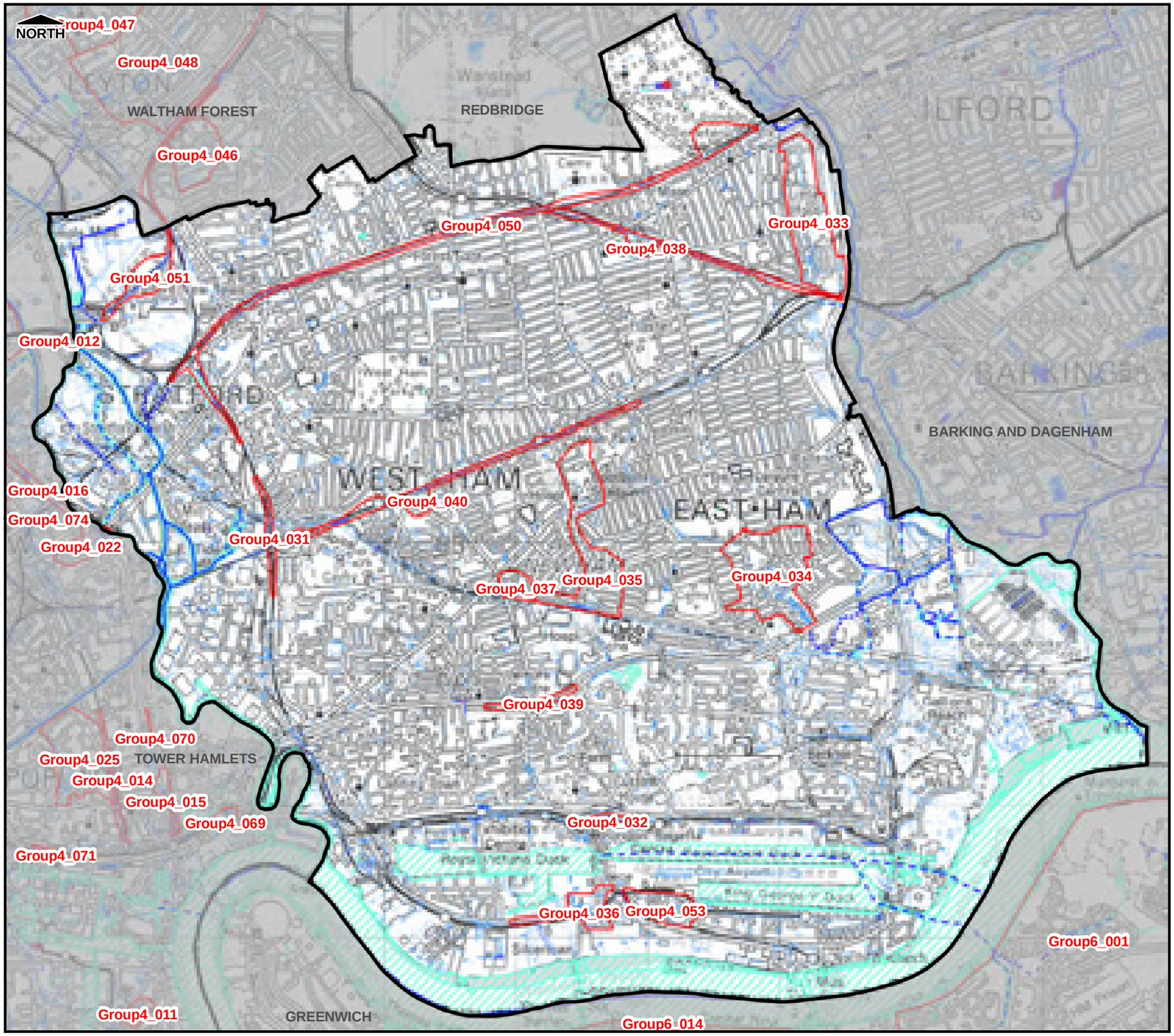
THE PURPOSE INTENDED



Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse
- Critical Drainage Area
- Permanent Water Bodies

Flood Depth

< 0.1m	0.5m to 1.0m
0.1m to 0.25m	1.0m to 1.5m
0.25m to 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	12/07/2011	D.HUGHES	S.IP

Surface Water Depth (m)
1 in 30 Chance of rainfall event occurring in any given year (3.33% AEP)

Consultants
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Flood Risk Management
Capita Symonds
Level Seven,
52 Grosvenor Gardens,
Belgravia,
London
SW1W 0AU

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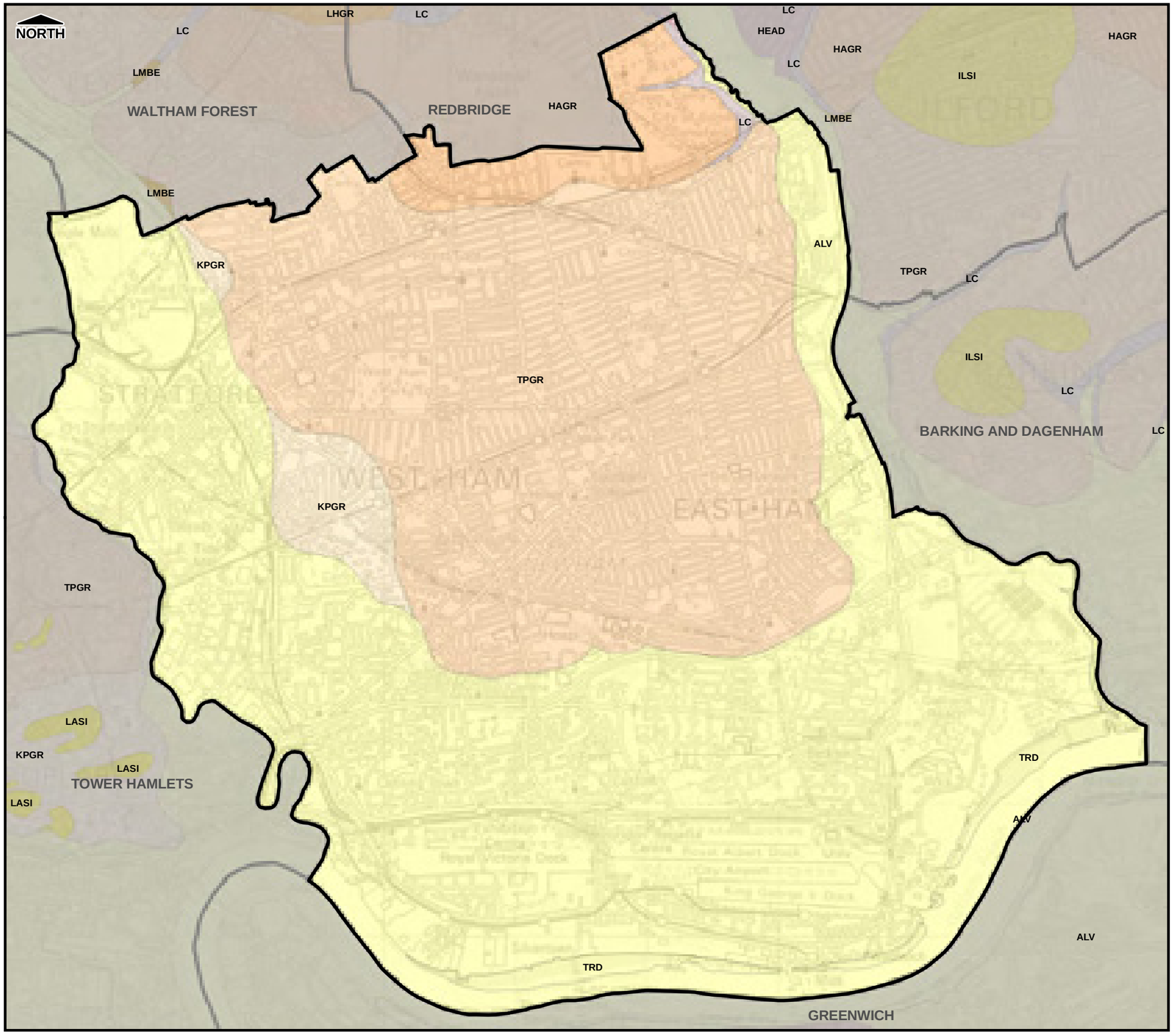
FIGURE 13

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig13_Depth_30.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary

Superficial Geology

- Alluvium (ALV)
- Hackney Gravel Member (HAGR)
- Head (HEAD)
- Ilford Silt Member (ILSI)
- Kempton Park Gravel Formation (KPGR)
- Langley Silt Member (LASI)
- Lynch Hill Gravel Member (LHGR)
- Taplow Gravel Formation (TPGR)
- Tidal River or Creek Deposits (TRD)

Bedrock Geology

- London Clay Formation (LC)
- Lambeth Group (LMBE)

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	07/04/2011	S.TURNBULL	S.IP

Geological Map

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London
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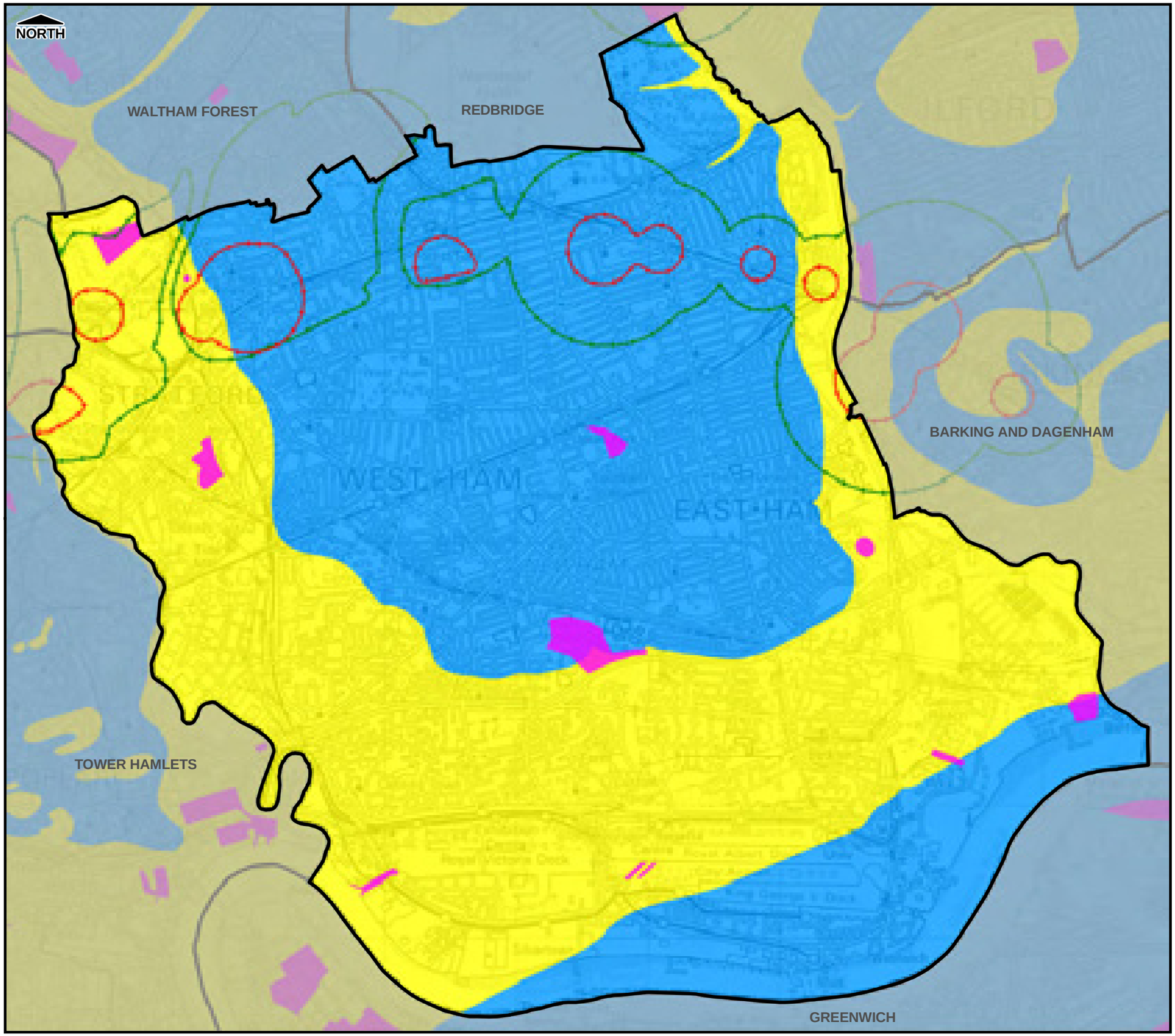
FIGURE 12

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig12_Geology.mxd



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Legend

- Borough Administrative Boundary
- Infiltration SUDs Potentially Suitable
- Infiltration SUDs Potentially Unsuitable
- Infiltration SUDs Suitability Uncertain
- Historic Landfill Site

EA Groundwater Source Protection Zone

- Inner Zone
- Outer Zone

Notes

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
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Infiltration SUDS Suitability Map

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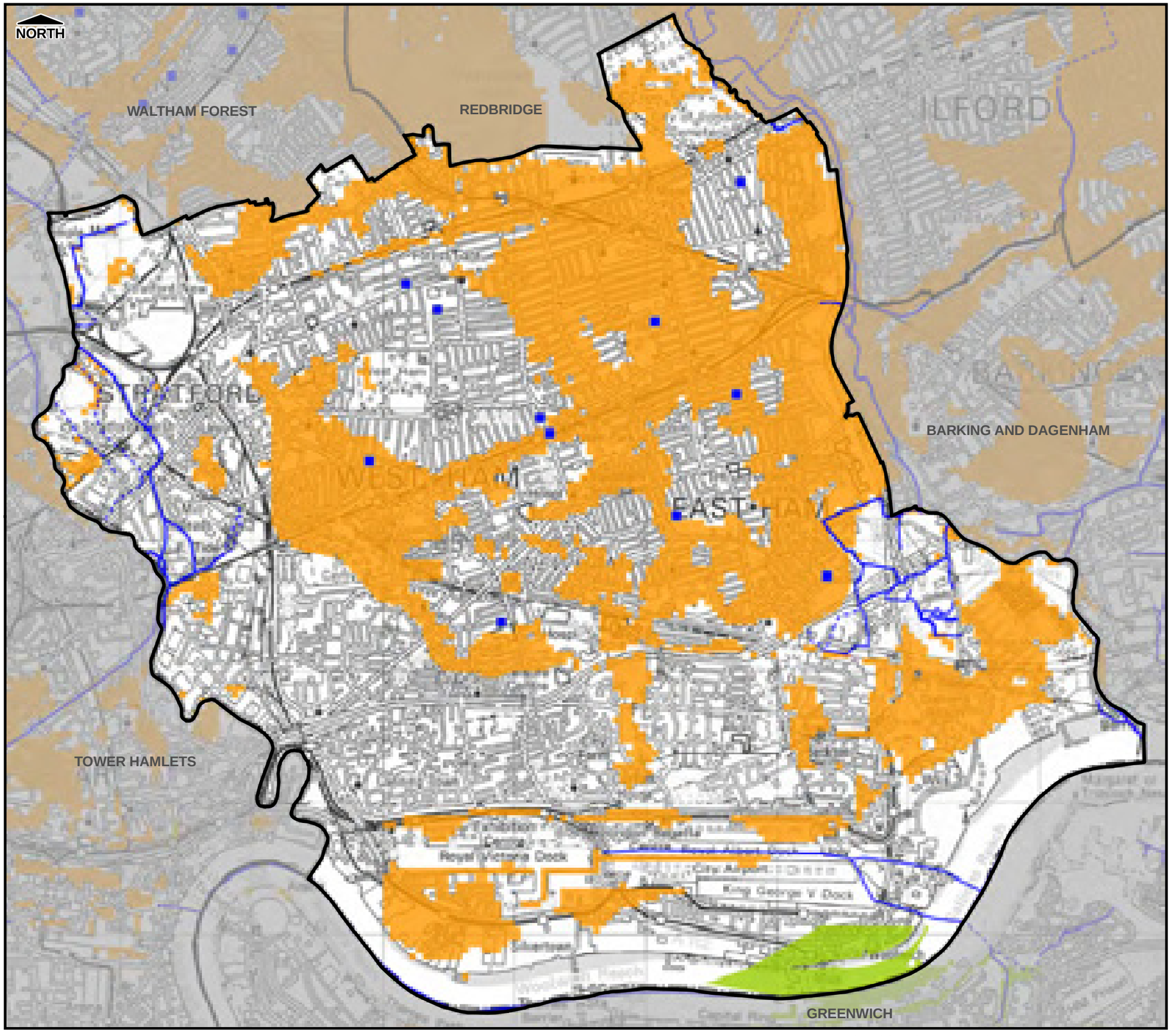
FIGURE 11

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARCmxds\GP4_Newham_Fig11_SUDS.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Groundwater Flood Incident (EA Records)
- Groundwater Flood Incident (Other Records)

Increased Potential for Elevated Groundwater in

- Permeable Superficial Deposits
- Consolidated Aquifers

Notes

1. The increased Potential for Elevated Groundwater map shows those areas within the London Boroughs where there is an increased potential for groundwater to rise sufficiently to interact with the ground surface or be within 2 m of the ground surface. Such groundwater rise could lead to the following consequences:
   - flooding of basements of buildings below ground level;
   - flooding of buried services or other assets below ground level;
   - inundation of farmland, roads, commercial, residential and amenity areas;
   - flooding of ground floors of buildings above ground level; and
   - overflowing of sewers and drains.
2. Incident records shown are generally unconfirmed and may include issues such as water main bursts or non-groundwater related problems.
3. Areas not shown to have increased potential for elevated groundwater should be considered to have a low potential for elevated groundwater – Lack of information does not imply 'no potential' of elevated groundwater in that area.
4. Includes groundwater flood mapping provided by JBA Consulting. Copyright © Jeremy Benn Associates Limited 2008 - 2011, partially derived from data supplied by the Environment Agency

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
1:30,000	07/04/2011	S.TURNBULL	S.IP

Increased Potential for Elevated Groundwater Map

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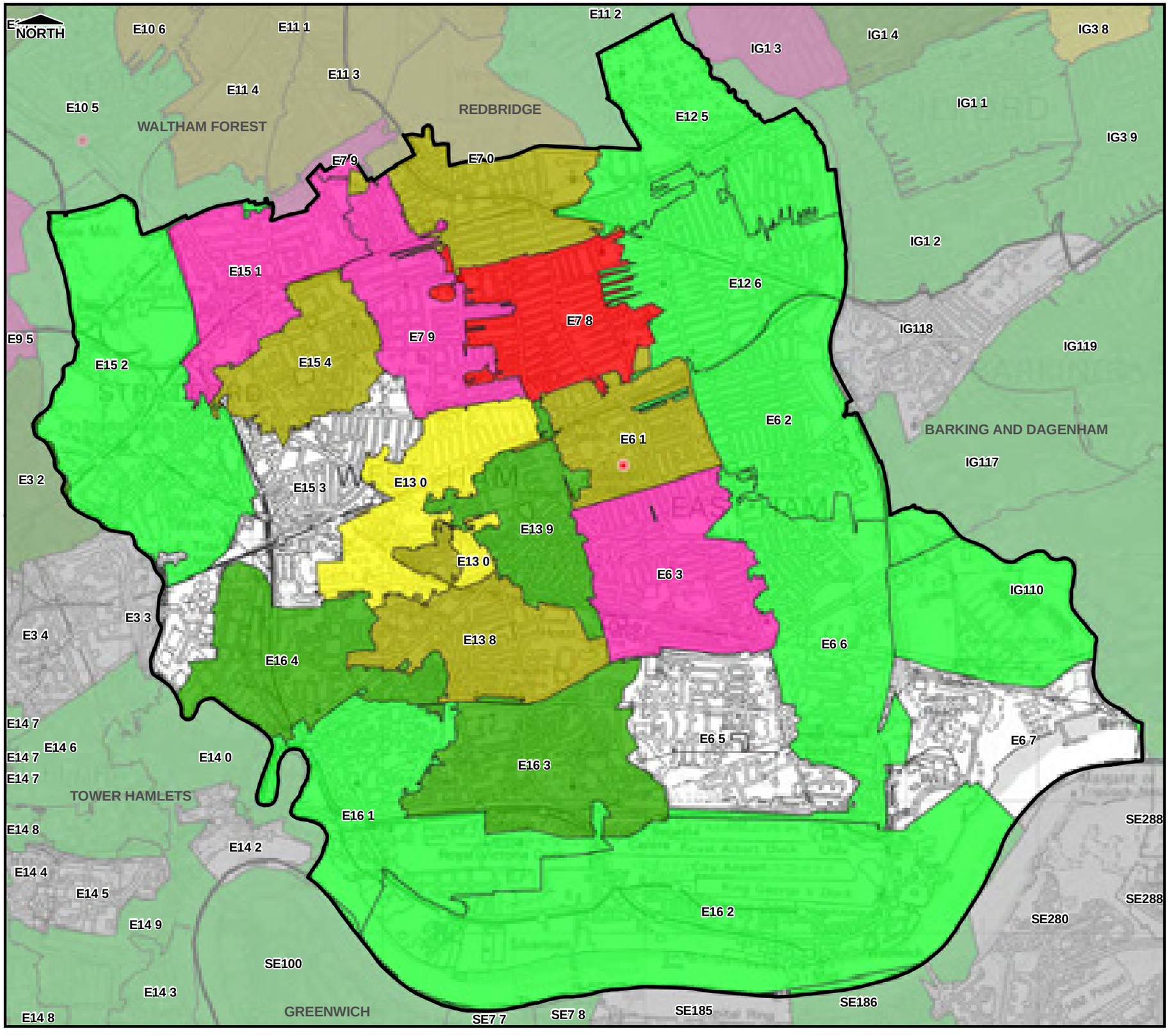
FIGURE 10

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig10_PotentialElevatedGWMap.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Sewer Flooding Incidents
- Sewer Flood Outline

No. of Sewer Flood Records

- None
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 50
- 51 - 100
- 101+

Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010

London Borough of Newham

Surface Water Management Plan

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Recorded Incidents of Sewer Flooding

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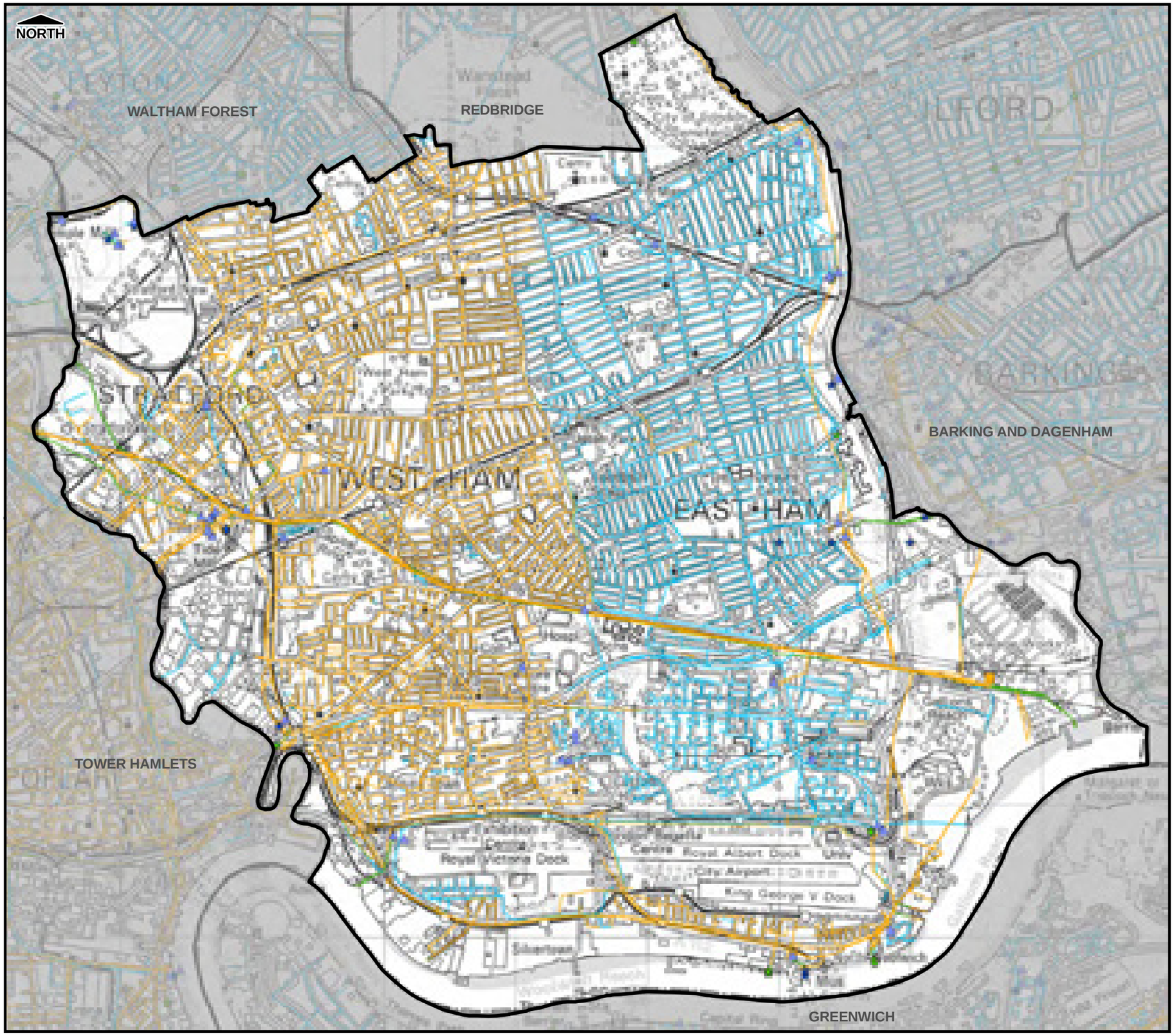
FIGURE 9

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig9_SewerIncidents.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Sewage Treatment Works Locations
- Pumping Stations

Combined Sewer Overflow Locations

- Other
- Pumping Stations
- Combined Sewer
- Surface Water Sewer
- Other Sewers

Notes

1. Foul drainage network not displayed;
2. Drainage networks with a diameter less than 150mm not displayed.
3. The pipe network shown on this drawing is as supplied by Thames Water. Any queries relating to connectivity should go directly to Thames Water.

London Borough of Newham

Surface Water Management Plan

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Thames Water Sewer Network

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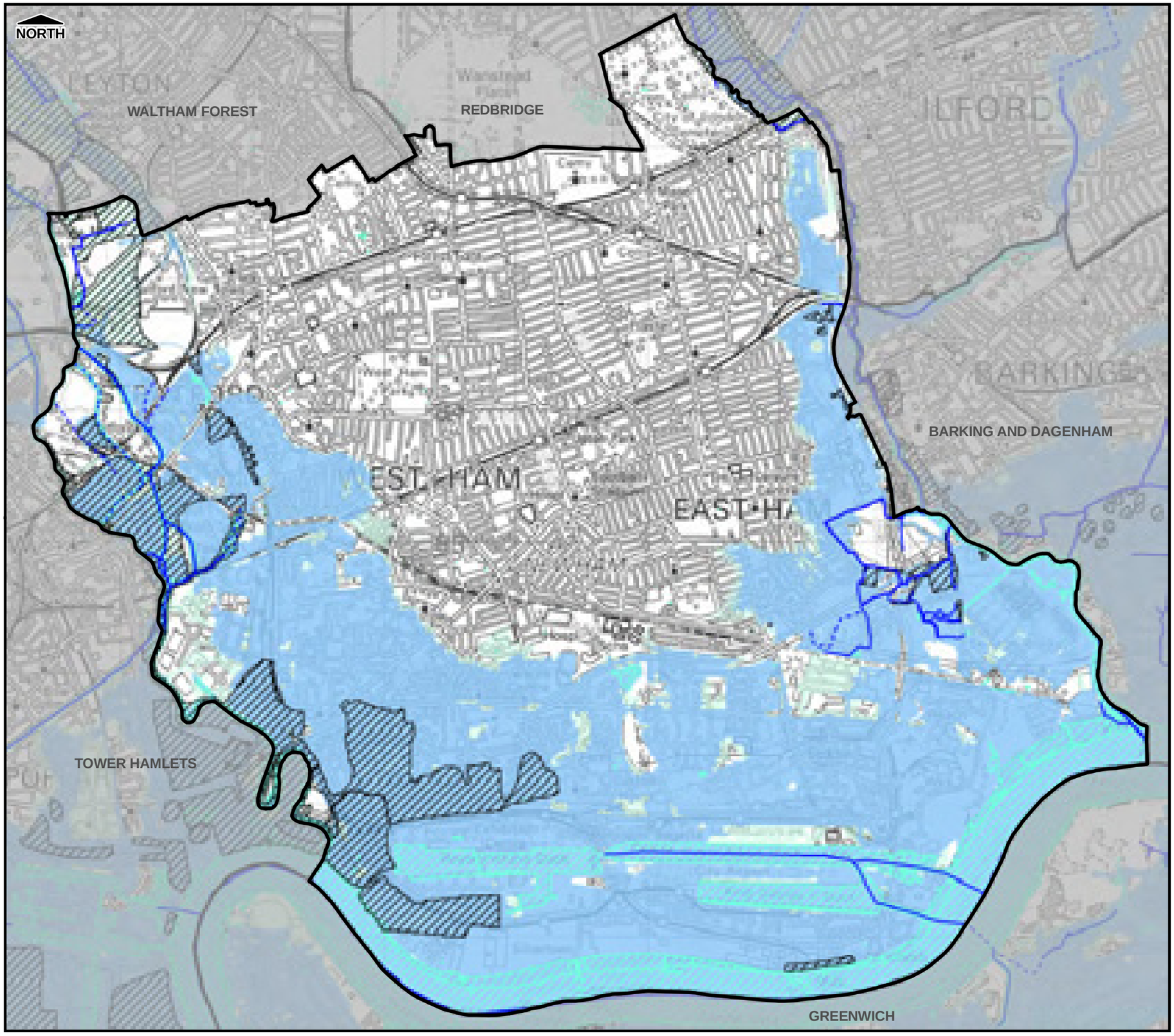
FIGURE 8

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARCImxds\GP4_Newham_Fig9_TWSewerNetwork.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Fluvial Flooding Incidents
- Historic Fluvial Flood Outline
- Environment Agency Flood Zone 3
- Environment Agency Flood Zone 2

Notes

1. Environment Agency Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.
2. Environment Agency Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

London Borough of Newham

Newham London

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
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Environment Agency Flood Map and Fluvial Flooding Incidents

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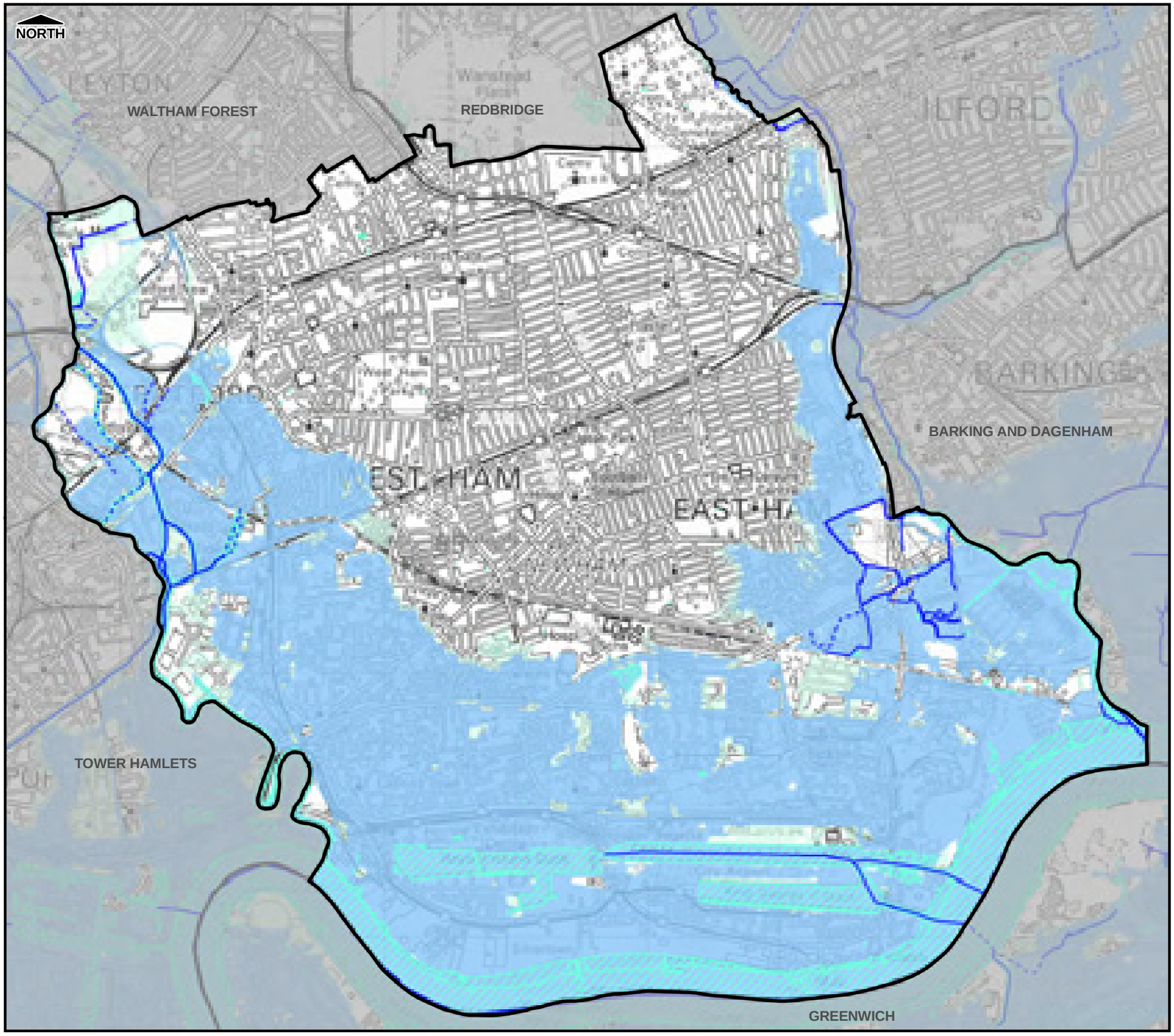
FIGURE 7

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig8_EAFloodMap_FlvIncidents.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Environment Agency Flood Zone 3
- Environment Agency Flood Zone 2

Notes

1. Environment Agency Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.
2. Environment Agency Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

London Borough of Newham

Surface Water Management Plan

Scale at A3	Date	Drawn by	Approved by
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Environment Agency Flood Map

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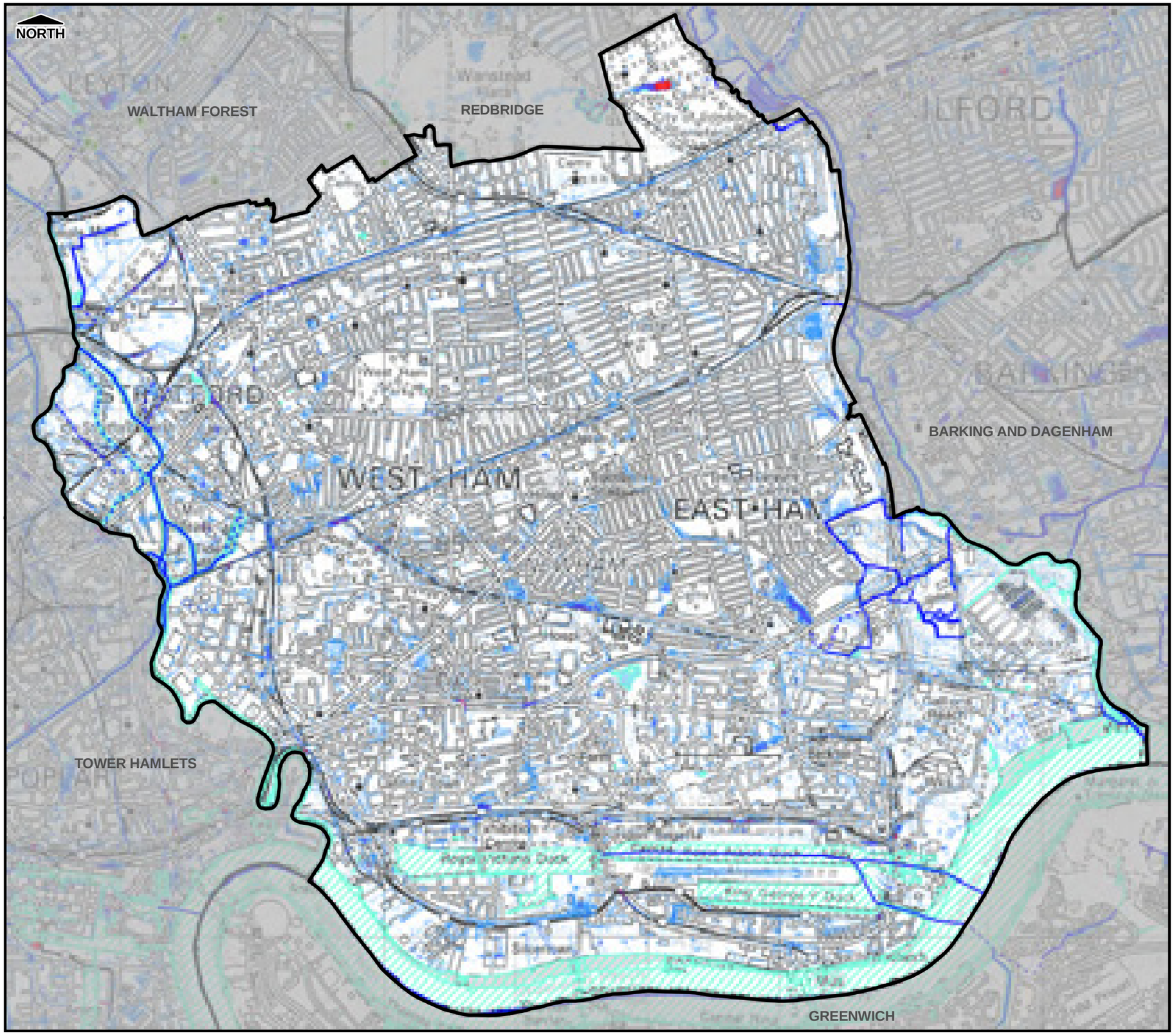
FIGURE 6

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig4_EAFloodMap.mxd



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED

Legend

- Borough Administrative Boundary
- Main River
- Ordinary Watercourse
- Culverted Watercourse (Main River)
- Permanent Water Bodies
- Surface Water Flooding Incidents
- Surface Water Flood Outline

Flood Depth

< 0.1m	0.5m - 1.0m
0.1m - 0.25m	1.0m - 1.5m
0.25m - 0.5m	> 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Users of this map should refer to section 3.2 of the Surface Water Management Plan for a complete description of limitations and accuracy of the flood/hazard extents shown.

London Borough of Newham

Newham London

Surface Water Management Plan

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1 in 100 year rainfall event depth and recorded surface water flood incidents

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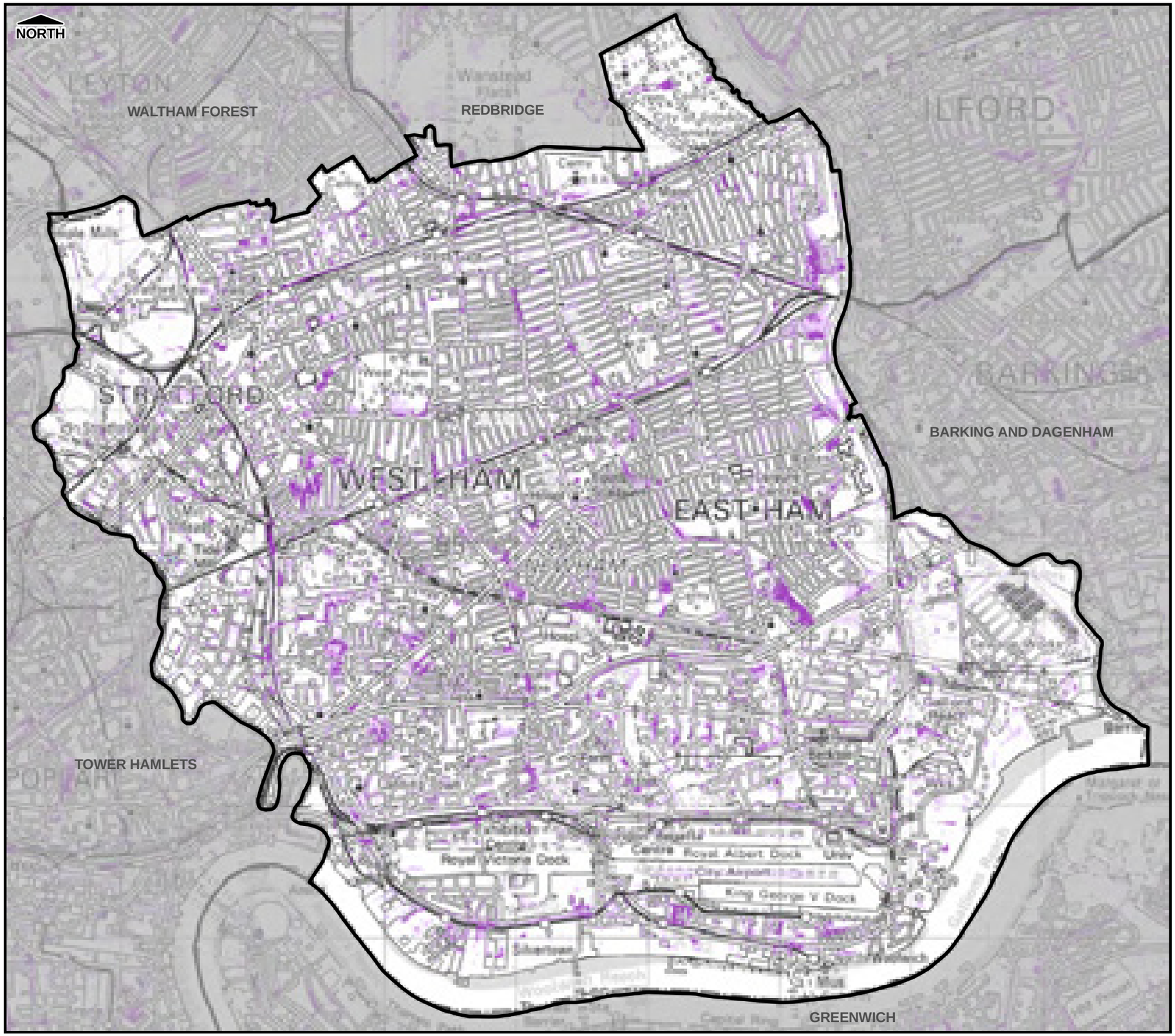
FIGURE 5

Filepath: L:\Environment\wet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig7_Depth_SWIncidents_100.mxd



Legend

- Borough Administrative Boundary
- 200yr Surface Water Event (Shallow)
- 200yr Surface Water Event (Deep)

Notes

London Borough of Newham

Surface Water Management Plan

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Environment Agency Flood Map for Surface Water

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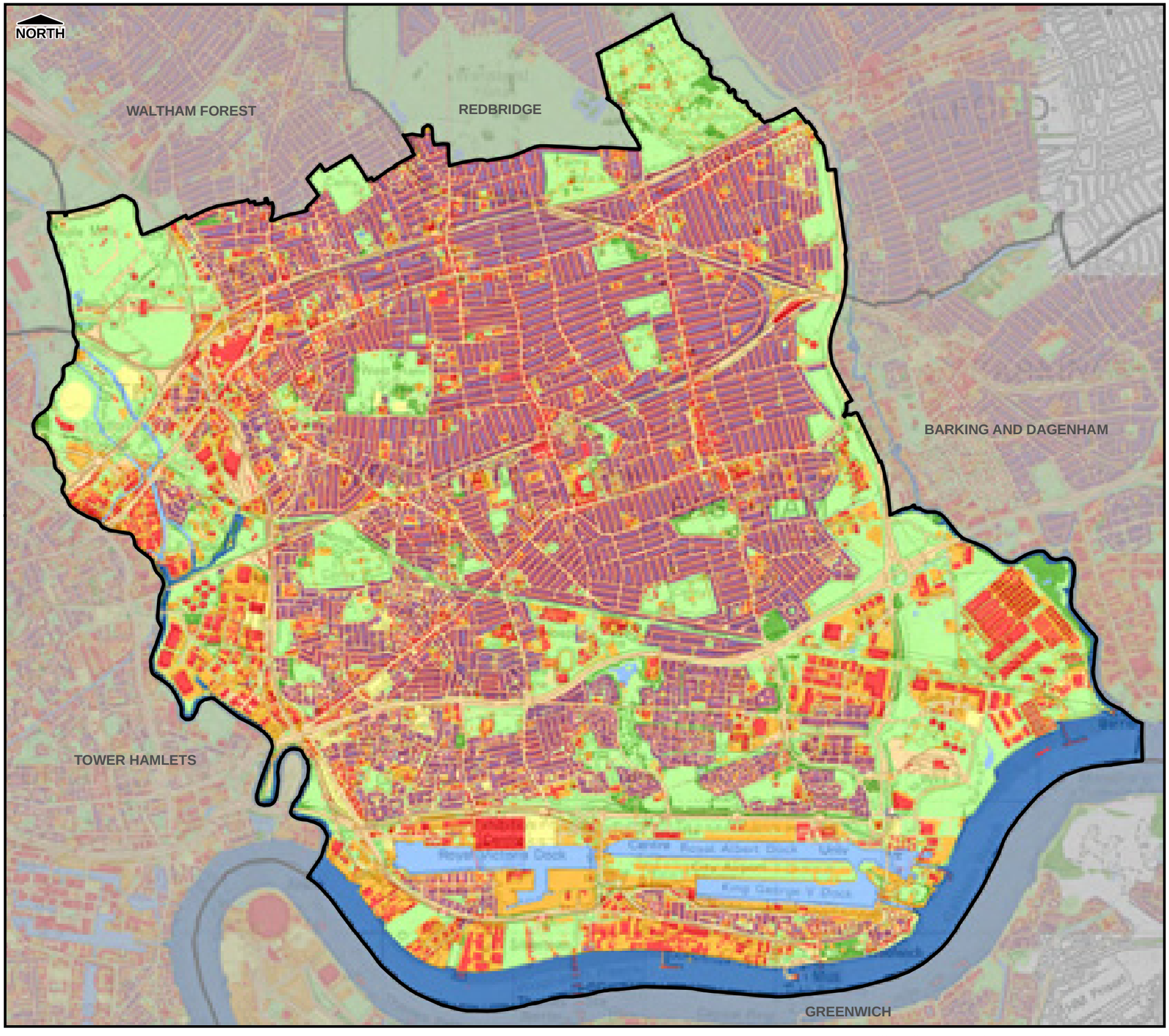
FIGURE 4

Filepath: L:\Environment\zwet\CS\046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig6_EAFloodMapSW.mxd



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Legend

- Borough Administrative Boundary

Land Use

- Building/Structure
- General Surface - Manmade
- General Surface - Mixed
- General Surface - Natural
- Inland Water
- Natural Environment
- Path, Roads Tracks
- Tidal Water
- Unclassified Land

Notes

London Borough of Newham

Surface Water Management Plan

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Land Use Areas

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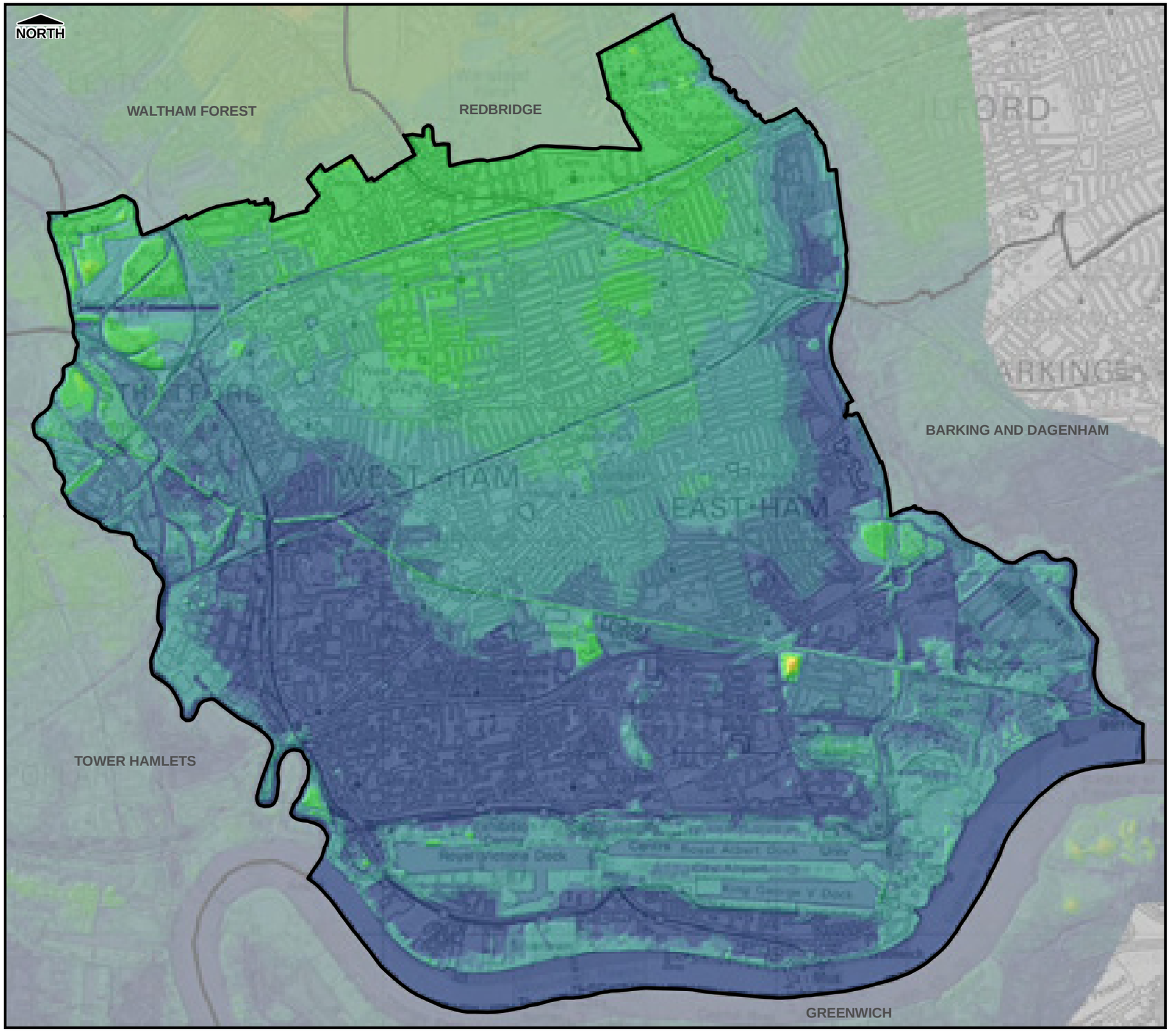
FIGURE 3

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig3_LandUse.mxd



Legend

Borough Administrative Boundary

Terrain Height (m)

-1 - 3	21 - 25
4 - 5	26 - 30
6 - 8	31 - 40
9 - 10	41 - 50
11 - 15	51 - 75
16 - 20	76 - 152

Notes

London Borough of Newham

Surface Water Management Plan

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LiDAR Topographic Survey

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FIGURE 2

Filepath: L:\Environment\zwet\CS046913_DrainLondon_Tier2\Group4\ARC\mxds\GP4_Newham_Fig2_LiDAR.mxd

Appendix H – Resilience Forum and Emergency Planner Information Pack

Background

Presently, surface water flooding is less well understood than other sources of flooding, partly because surface water events tend to happen and disperse quickly meaning that there is a lack of accurate and consistent records and partly because they are not tied to readily identifiable features such as rivers or the sea. Therefore this SWMP offers an opportunity to communicate up to date information about locations at risk from surface water flooding to those with an interest. Responses in an emergency will be informed by known surface water flooding locations, especially near public buildings and major transport routes and important infrastructure.

The purpose of this information pack is to assist in communicating surface water flood risk to the London Local Resilience Forum, and Emergency Planners within the London Resilience Partnership to enable them to ensure that incident management plans are updated based on the improved understanding of surface water flooding. SWMP mapping outputs and knowledge will be used to:

- Update Community Risk Registers (CRR);
- Update Multi-Agency Flood Plans (MAFP).

This pack is presented as a Frequently Asked Questions (FAQ) document and contains information that addresses the following points:

1. How can SWMP outputs improve Community Risk Registers?
2. How can SWMP outputs improve Multi-Agency Flood Planning?
3. How do SWMP outputs compliment the Flood Forecasting Centre's Extreme Rainfall Alert (ERA)?
4. Examples of Good Practice

In updating Multi-Agency Flood Plans, as well as the neighbouring boroughs of Tower Hamlets, Hackney, Waltham Forest, Redbridge and Barking and Dagenham the LB of Newham also have a responsibility to partner with other key stakeholders and risk management authorities, who share the responsibility for decisions and actions. Ideally, the informal relationships established within the context of the Drain London programme should be formalised to ensure clear lines of communication and continued mutual cooperation through the development of a Memorandum of Understanding. This should include appropriate aspects for Surface Water Flood Risk Management.

At a borough level, Newham have set up a Flood Working Group in response to the Flood and Water Management Act, which includes departmental representatives from strategic planning, emergency planning, drainage and highways, in recognition of the cross-department input require on managing local flood risk.

The North East London Local Resilience Forum (LRF) is one of six London Forums, bringing together the London Boroughs of Barking & Dagenham, Havering, Newham, Redbridge, Waltham Forest. The Forum is responsible for overseeing the local implementation of the policy set by the London Local Resilience Forum and ensuring that all organisations work together in planning for emergencies. The North East LRF creates a 'community risk register' of assessed risks that the Council and other responders must take into account when planning for emergencies and planning for business continuity events. As well as local

authorities, membership of the North East London LRF include representatives from emergency services and government agencies.

1. How can SWMP outputs improve Community Risk Registers?

Community Risk Registers (CRR) are prepared by Category 1 responders and are required as part of the Civil Contingencies Act (CCA) 2004. The CCA requires that Category 1 responders undertake risk assessments and maintain these risks in a CCR. In this context risks are defined as events which could result in major consequences, and they include risks from flooding.

Outputs from SWMP can be used to reduce the uncertainties associated with assessing the likelihood and impact of surface water flooding (see Community Risk Register HL18 for more information on current risk assessment). SWMP presents an opportunity for the identification of vulnerable sites and populations which may be at increased risk, and allows for risk-based prevention or mitigation actions to be taken.

2. How can SWMP outputs improve Multi-Agency Flood Plans?

Multi-Agency Flood Plans (MAFP) are specific emergency plans which should be developed by LRFs, to deliver a coordinated plan to respond to flood incidents. MAFPs recognise the need for specific flooding emergency plans, due to the complex nature of flooding and the consequences that arise. Guidance on producing a MAFP is available at http://www.ukresilience.gov.uk/media/ukresilience/assets/flooding_ma_planning_guidance_0208.pdf.

Outputs from SWMPs should inform the development of, or update, the MAFP.

The SWMP surface water mapping should be used as an initial indicator of a possible risk. A Flood Risk Assessment at a site shown as being at risk of surface water flooding should consider:

- Impacts on flood receptor sites
- The degree of receptor vulnerability
- In the event of surface water flooding to the site, has safe access to / egress from the site been adequately considered?

The table below indicates the SWMP maps which are of potential use to emergency planning, and indicates which maps may be suitable for updating existing MAFP maps:

Issue	SWMP maps	Consider updating existing MAFP maps?
Surface water flood risk	Figures 13 to 22	Yes – more detailed methodology to that used for the MAFP.
Increased potential for elevated groundwater	Figure 10	Yes – more detailed methodology to that used for the MAFP.

Table H-1: SWMP maps of potential use to emergency planners

3. How do SWMP outputs compliment the Flood Forecasting Centre's Extreme Rainfall Alert (ERA)?

In 2008 the Met Office and the Environment Agency set up the Flood Forecasting Centre to provide services to emergency and professional partners. The Flood Forecasting Centre provides an Extreme Rainfall Alert (ERA) service to Category 1 and Category 2 responders. The ERA is issued at county level and is used to forecast and warn for extreme rainfall that could lead to surface water flooding, particularly in urban areas. It is designed to help local response organisations manage the impact of flooding via two products:

1. Guidance – issued when there is a 10% or greater chance or extreme rainfall;
2. Alert – issued when there is a greater than 20% chance of extreme rainfall.

The ERA cannot provide site-specific real-time surface water flood forecast, but does offer a county level alert of impending rainfall. The alert is based on the probability of rainfall occurring, rather than being a definitive forecast.

Surface water flooding has very short lead times and is hard to predict in real time because local topography and drainage infrastructure affect the direction of runoff and location of flooding. However, the assessment carried out as part of this SWMP study has taken an important step towards the likely flow pathways and locations of ponding of surface water. Used in parallel with the ERA, this can be used to improve emergency planning and responses for surface water flooding events.

4. Examples of Good Practice for Emergency Planners

- **Ensure that a programme of engagement on flood risk awareness is initiated within the Borough.** Meet with key corporate communications teams to agree an approach to social change, education and awareness raising inline with the needs of the Borough.

- **Build trust -** Public and stakeholder trust in authorities through **long term, transparent engagement.**

    - Ensure there are key messages in the that encourage attitude and behaviour change with the public. This will help to address misconceptions that flooding results from a failure on someone's part.

    - Educate the public to help them better understand where responsibilities lie, changes they can make to their own lifestyles, and actions they can take to physically reduce personal flood risk.

    - Encourage communities towards creating their own community action/response plans to support wider ownership of risk and responsibilities

    - Consider holding face to face interviews with at -risk families and groups to better inform your Community Risk Register. This will help both you and them to better understand risk and plan to manage it.

    - Establish a **common baseline for flood data** and information in line with EA requirements. Set up a Borough '**One-Stop Shop'** to enable efficient information consolidation and data sharing. This will support efficient planning and updating of the MAFP.

    - **Develop a surface water flooding response plan with vulnerable receptors as external partners**. Vulnerable receptors could include hospitals, schools and care homes. Identify these through Emergency Planning and other relevant forums and build into stakeholder engagement. This will assist with prioritisation decisions. For example 'early warning' processes, appropriate measures, funding and resourcing.

    - Link the actions from the SWMP directly to the **Flood Risk Management Strategy** for the Borough such that a programme of work is visible.

- Link with the Planning Department's **Strategic Flood Risk Assessment** (SRFA) to ensure that Emergency Planners are involved in land use decisions for new development.

- Create a key facts and 'what to do' section for surface water flooding in **emergency handbooks**. Provide easy- to- reach contact points, and regularly update your website

- Work with other agencies, such as the **Environment Agency flood alert/warning schemes**, in the interests of cost effectiveness and good communication - but still own the responsibility for your borough. Use others' information to reinforce your own process.

Appendix G – Spatial Planning Information Pack

Background

PPS 25 sets out national planning guidance for development in relation to flood risk. It takes a risk based approach and categorises land uses into different vulnerabilities, which are appropriate to different flood zones.

PPS 25 applies to all forms of flood risk, however, surface water, groundwater and ordinary watercourse flood risks are generally less well understood than fluvial or coastal flood risk. In part this is due to the much faster response times of surface water flooding, a perception that the impacts are relatively minor and the highly variable nature of influences, e.g. storm patterns, local drainage blockages, interactions with the sewer system.

However climate change models are predicting more frequent heavy storms and there is emerging evidence that this is already happening. It is also clear from the flooding that occurred in several parts of England in summer 2007 that surface water flooding can have major impacts. In the heavily urbanised area of London, the risks are significant and it is important that appropriate consideration is given to these risks when new development is proposed.

The planning system is a key tool in reducing flood risk, and with this additional information, this can apply to the surface water risk as well as fluvial and tidal risk.

Since April 2011, London Boroughs have been given the roles of Lead Local Flood Authorities (LLFAs) by the Flood and Water Management Act 2010. This means that each borough has new duties. The Planning Department has an important role to play in delivering these new duties and must ensure that it forms part of authority wide co-ordination of the LLFA role.

Whilst this document is titled a SWMP, it also identifies flood risk at ordinary watercourses and has been adapted to include consideration of groundwater flood risk through the identification of a map showing “Increased Potential for Elevated Groundwater (iPEG).

The Greater London Authority will examine the 33 SWMPs across London to update the Regional Flood Risk Appraisal during 2012.

Using the SWMP to update the borough SFRA

The SFRA for the LB of Newham contains little information on historic analysis of surface water, groundwater and ordinary watercourse flood risk. Groundwater records gathered show that historic incidents generally occurred between East Ham and Little Ilford.

The mapping within this SWMP (Figures 13 to 17 in Appendix D) shows some areas that are vulnerable to extensive deep accumulations of water (>0.5m), these area have a high certainty of flooding during extreme storms and the damage occurring is likely to be significant. The mapping also shows some small areas of potentially deep (>0.5m), these area may have particular risks associated with them, but may also occur due to irregularities in mapping and modelling. The mapping also shows areas of shallower flooding (<0.5m), some isolated and some more extensive flooding. Maps show general flow directions and approximate velocities (in the form of ‘hazard’ maps) as even relatively shallow water flowing a high velocities can be a threat to life and can cause damage.

The production of this SWMP will be a significant addition of new/updated data and will form part of the LB of Newham’s spatial planning evidence base in regards to flood risk. In due

course, this new/updated information will be taken into account in future reviews of the SFRA. The SFRA should consider these risks in the following ways:

- Large areas of deep (>0.5m) flooding should be shown as Local Flood Risk Zones, unless there is evidence to suggest that these risks have been mitigated, for example by high capacity drainage or pumping infrastructure.
- Small, isolated areas of deep (>0.5m) flooding should be investigated to determine how likely they are to be at flood risk but do not need to be shown if there is no significant risk.
- Large areas of shallower flooding should be identified as Local Flood Risk Zones if they pose a significant risk, but do not need to be shown if the risks are relatively minor.
- Smaller isolated areas of shallower flooding should generally not be identified as Local Flood Risk Zones, unless there is a particular significant risk associated with that area, as it must be expected that most areas will be affected to some extent by rainwater.
- Routes of fast flowing water may be considered as Local Flood Risk Zones if they pose a significant risk.
- Areas of Increased Potential for Elevated Groundwater, should be shown where they are likely to pose a significant risk of flooding or where they are likely to affect the nature of future development, especially for the design and use of sub-surface spaces.

Identifying an area as a Local Flood Risk Zone, should mean that it is then be treated in a similar way to Environment Agency Flood Zone 3, namely that a Flood Risk Assessment is required and measures should be taken to reduce the likelihood and impact of any flooding.

Where a Critical Drainage Area contributes significant amounts of surface water to a Local Flood Risk Zone, the SFRA should identify this and suggest strict application of sustainable drainage measures in line with the London Plan Sustainable Drainage Hierarchy.

Using the SWMP to update policies in Development Plan Documents

Ideally the review of the borough SFRA should be a pre-cursor to any significant change to the Core Strategy and development control policies. Therefore reference to the SFRA should automatically update the approach to local flood risks. Where the SFRA has not been updated, the review of Development Plan Documents should consider the same steps outlined above for the SFRA review.

Using the SWMP to influence major areas of redevelopment

Where major development areas are proposed, either in the London Plan or within the Core Strategy DPD, these should be examined for:

- Local Flood Risk Zones that affects the area
- Increased Potential for Elevated Groundwater
- Contribution of run-off to Local Flood Risk Zones beyond the actual redevelopment area.

Given the large scale of major developments, it is unlikely that the Local Flood Risk would prevent redevelopment taking place, but it may affect the location, uses, design and resilience of the proposals. Therefore, a Flood Risk Assessment needs to be undertaken and it should consider:

- the location of different types of land use within the site(s)
- the layout and design of buildings and spaces to take account of flood risk, for example by dedicating particular flow routes or flood storage areas

- measures to reduce the impact of any flood, through flood resistance/resilience measures/materials
- incorporating sustainable drainage and rainwater storage to reduce run-off to adjacent areas
- linkages or joint approaches for groups of sites, possibly including those in surrounding areas

Using the SWMP to influence specific development proposals

Where development is proposed in an area covered wholly or partially by a Local Flood Risk Zone, this should trigger a Flood Risk Assessment, as already required under PPS25.

Whilst some small scale developments may not be appropriate in high risk areas, in most cases it will be a matter of ensuring that the Flood Risk Assessment considers those items listed under major developments above and also considers some or all of the following site specific issues:

- Are the flow paths and areas of ponding correct, and will these be altered by the proposed development?
- Has the site been planned sequentially to keep major surface water flow paths clear?
- Has exceedance of the site's drainage capacity been adequately dealt with? Where will exceedance flows run off the site?
- Could there be benefits to existing properties at risk downstream of the site if additional storage could be provided on the site?
- In the event of surface water flooding to the site, have safe access to / egress from the site been adequately considered.
- Have the site levels been altered, or will they be altered during development? Consider how this will impact surface water flood risk on the site and to adjacent areas.
- Have inter-dependencies between utilities and the development been considered? (for example, the electricity supply for building lifts or water pumps)

Specific Locational Considerations

Within the LB of Newham, the following major redevelopment areas have already been identified.

Opportunity Area	Local Flood Risk
Stratford and Lower Lee Valley	• Fluvial: River Lee • Surface Water: Railway cuttings • Groundwater: parts of Stratford Marsh and Mil Meads
Canning Town and Custom House	• Fluvial/Tidal: River Lee and River Thames • Surface Water: Vicinity of Vincent Street
Forest Gate	• Surface Water: Railway cuttings • Groundwater: Majority of opportunity area
Royal Docks and Thameside West	• Fluvial/Tidal: River Lee and River Thames • Surface Water: Water ponding at low points along North Woolwich Road and Wythes Road. • Groundwater: parts of Silvertown and North Woolwich

Table G-1: Specific Locational Considerations

Mapping Checklist

Table G-2 below indicates the SWMP maps located in Appendix D which are of potential use to spatial planning, and indicates which maps may be suitable for replacing existing SFRA maps:

Issue	SWMP maps	Consider replacing existing SFRA maps?
Surface water flood risk	Figures 13 to 22	Yes – more detailed methodology to that used for the SFRA.
Increased potential for elevated groundwater	Figure 10	Yes – more detailed methodology to that used for the SFRA.
Infiltration SUDs suitability map	Figure 11	Yes – provides a consistent initial infiltration SUDs screening process for all London Boroughs, but does not replace on-site assessments.
Recorded incidents of sewer flooding	Figure 9	Yes – similar method (based on postcode sector) but brings the records up-to-date to June 2010.

Table G-2: SWMP maps of potential use to spatial planners