4.2.15 Optical Wavelength Services (OWS) (L.34.1.4.6, M.2.1.2)

Qwest has served OWS customers since 1999, with more than 30 major customers in service today including Federal Agencies, Fortune 500 customers, universities, and cable companies.

Qwest's Optical Wavelength (λ) Service (OWS) provides dedicated, transparent networks for Agencies [redacted] as required by the traffic model. OWS is implemented over Dense Wavelength Division Multiplexing (DWDM) equipment for intra-city and inter-city applications. OWS offers bi-directional 2.5 Gbps (OC-48 equivalent) and 10Gbps (OC-192 equivalent) wavelengths with high-speed, unprotected, and protected wavelength options. Qwest's nationwide [redacted] infrastructure enables a broad range of technical capabilities and lowest cost per unit for transport of data. Our service approach provides flexibility and can be adapted to almost any customer architecture (ring, mesh, or linear).

Qwest's network infrastructure will provide fully compliant, highly reliable and scalable service to Agencies. [redacted]

Qwest supports all of the capabilities, features, and interfaces required for Networx OWS service. Qwest's OWS is a low-risk solution for Agencies, because our existing network will require only minor modifications to meet all OWS service requirements, and our network capacity will easily accommodate forecasted OWS traffic loads now and in the future. Qwest has many years of experience providing OWS and currently provides OWS to numerous Fortune 500 clients and Government Agencies, [redacted]

[redacted]

Figure 4.2.15-1 provides a mapping of OWS Narrative Requirements to Qwest's proposal for OWS.

Figure 4.2.15-1. Table of OWS Narrative Requirements

Req_ id	RFP Section	Proposal Response
31390	C.2.5.4.1.1.4 (7)	4.2.15.3.1
31392	C.2.5.4.1.1.4 (8)(b)	4.2.15.3.1
31397	C.2.5.4.1.1.4 (12)(a)	4.2.15.3.1
31399	C.2.5.4.1.1.4 (12)(c)	4.2.15.3.1
31400	C.2.5.4.1.1.4 (12)(c)	4.2.15.3.1
31428	C.2.5.4.1.4(2)	4.2.15.8
31429	C.2.5.4.1.4(3)	4.2.15.8
31539	C.2.5.4.2.4(2)	4.2.15.8

Figure 4.2.15-2 provides a list of ICB CLIN and Case Numbers.

Figure 4.2.15-2. Table of ICB CLIN and Case Numbers

CLIN	Case Number	Case Description
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

4.2.15.1 Reserved (L.34.1.4.6(a))

4.2.15.2 Reserved (L.34.1.4.6(b))

4.2.15.3 Satisfaction of OWS Requirements (L.34.1.4.6(c))

Qwest's OWS is a point-to-point offering provisioned over our DWDM infrastructure. The service is built upon Qwest's domestic fiber network, which rides along railroad rights-of-way. [redacted] Our fiber network provides exceptional reliability to Qwest's OWS service. The following

three sections describe how Qwest will satisfy the capabilities, features, and interfaces requirements of the Request for Proposal (RFP).

4.2.15.3.1 Satisfaction of OWS Capabilities Requirements (L34.1.4.6(c), C.2.5.4.1.4)

OWS network infrastructure enables a broad range of technical service capabilities, specifically, Qwest supports all technical capabilities required for OWS. Our service approach provides significant flexibility in regard to the delivery of service nationally and in metro areas through Qwest-owned DWDM and fiber facilities. The service currently supports 2.5 Gbps and 10 Gbps wavelengths. [redacted]

Figure 4.2.15-2 provides a brief description of Qwest's technical approach to fully meet the Government's capability requirements for OWS. Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for OWS. The text in Figure 4.2.15-2 provides the technical description required per L.34.1.4.6 (c) and does not limit or caveat Qwest's compliance in any way.

Figure 4.2.15-2. Qwest Technical Approach to OWS Capabilities

ID #	Name of Capability	[redacted]
1	End to End Wavelength Termination	[redacted]
2	Reserved	
3	Reserved	
4	Transmission	[redacted]

ID #	Name of Capability	[redacted]
	Rates	[redacted]
5	Clock Transparency	[redacted]
6	Protocol Transparency-Metro	[redacted]
7 [Optional]	Protocol Transparency-CONUS & Non-Domestic	[redacted]
8	Byte Transparency	[redacted]
9	Concatenation	[redacted]
10	Channelization	[redacted]
11	Wavelength Delivery	[redacted]
12	Access Methods	[redacted]
13	CPE Support	[redacted]
14	Efficient Transport	[redacted]

[redacted]

Qwest's OWS supports the full range of topology requirements presented in the RFP.

The following are narratives required by RFP Section J.9 for OWS capabilities.

[redacted]

Protocol Transparency (Req_ID 31390, C.2.5.4.1.1.4(7))

Qwest provides complete rate and protocol transparency on [redacted]

Byte Transparency (Req_ID 31392, C.2.5.4.1.1.4(8(b)))

Qwest's OWS solution is fully transparent. [redacted] illustrates the processing of the SONET overhead bytes.

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]

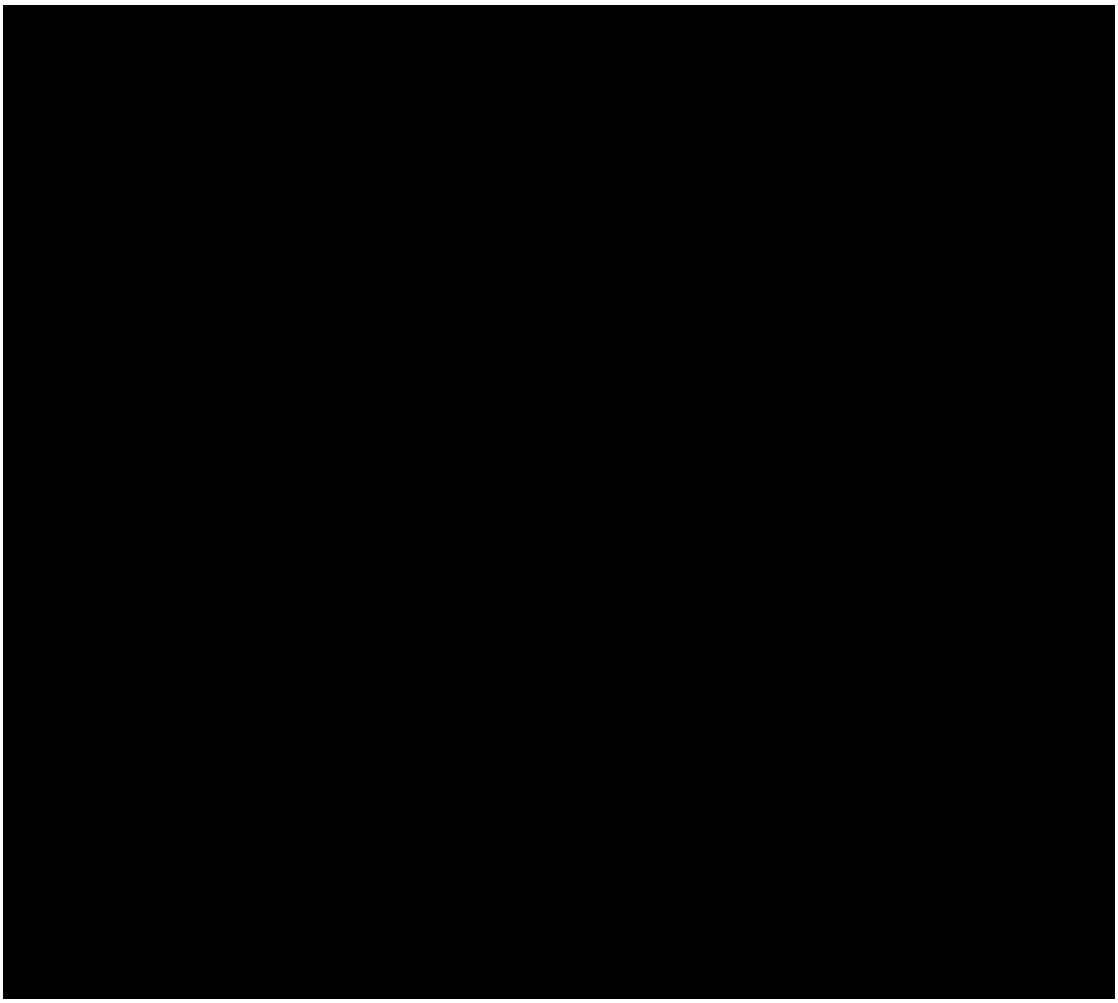
Access Methods - Alternatives (Req_ID 31397, C.2.5.4.1.1.4(12(a)))

Qwest provides end-to-end service on our OWS service including SEDs if necessary. We offer access through on-net facilities, dark fiber, and third-party wavelength providers to SDPs. [redacted] illustrates the OWS local access options of:

- On-net fiber to the SDP
- Third-party wave loop to the SDP
- Dark fiber or mid-span meet to the SDP

[redacted]

[redacted]



Access Methods – Optical Interface Reach (Req_ID 31399, C.2.5.4.1.1.4(12)(c))

Qwest provides end-to-end service to include local access. Qwest maintains many solutions to enable any reach necessary, optimizing for lowest cost and best performance. When access is provided, Qwest will specify the appropriate reach for the optical interface.

Access Methods – Mediation Devices (Req_ID 31400, C.2.5.4.1.1.4(12(c)))

Qwest provides local access with our OWS service. [redacted] If need be, Qwest's standard selection and certification process will be applied to identify and certify alternative devices.

4.2.15.3.2 Satisfaction of OWS Features Requirements (L.34.1.4.6(c), C.2.5.4.2)

Figure 4.2.15-8 provides a brief description of Qwest's technical approach to fully meet the Government's feature requirements for OWS. Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for OWS. The text in Figure 4.2.15-8 provides the technical description required per L.34.1.4.6 (c) and does not limit or caveat Qwest's compliance in any way.

Figure 4.2.15-8. Qwest's Technical Approach to OWS Features

ID #	Name of Feature	[redacted]
1 [Optional]	Customer Network Management (CNM) - Level 1	[redacted]
2 [Optional]	Customer Network Management (CNM) - Level 2	[redacted]
3	Equipment Protection 1:1 – CPE	[redacted]
4	Equipment Protection 1+1 – CPE	[redacted]

ID #	Name of Feature	[redacted]
5	Equipment protection - Network Side	[redacted]
6	Geographical Diversity - Non-Domestic and CONUS Wavelengths	[redacted]
7	Geographical Diversity - Metro Wavelengths	[redacted]
8	Geographic Diverse Wavelength-single site delivery	[redacted]
9 [Optional]	Geographic Diverse Wavelength-dual site delivery	[redacted]
10 [Optional]	Geographic Diverse Wavelength-single metro hub	[redacted]
11 [Optional]	Geographic Diverse Wavelength-dual metro hub	[redacted]
12 [Optional]	Protected Non-Domestic Wavelength	[redacted]
13 [Optional]	Protected CONUS Wavelength	[redacted]
14	Protected Metro Wavelength	[redacted]

[redacted]

The RFP describes Agency requirements for configurations that provide various levels of service protection. The Government has asked for a "routine" level of availability with three different levels of protection. Qwest supports the three routine configurations described in RFP feature numbers 3, 4, and 5. [redacted]

[redacted]

[redacted]

[redacted]

4.2.15.3.3 Satisfaction of OWS Interface Requirements (L.34.1.4.3(a), C.2.5.4.3)

Qwest OWS supports all required UNIs including OC-48, OC-192, STM-16, and STM-64 optical interfaces in accordance with GR-253 and ITU-T G.707. [redacted] is a listing of SEDs that Qwest will deploy that enable Qwest to fully meet the interface requirements for OWS when a suitable interface does not exist in the network. Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for OWS. The text in Figure 4.2.15-12 provides the technical description required per L.34.1.4.3 (a) and does not limit or caveat Qwest's compliance in any way.

Figure 4.2.15-12. Qwest Provided OWS Interfaces at the SDP

UNI Type	Interface Type	Standard	Frequency of Operation	Payload Data Rate or Bandwidth	Signaling or Protocol Type	[redacted]
1	Optical	GR-253, ITU-T G.707	1310 nm	2.5Gbps	SONET or SDH	[redacted]
2	Optical	GR-253, ITU-T G.707	1310 nm	2.5Gbps	SONET or SDH Concatenated	[redacted]
3	Optical	GR-253, ITU-T G.707	1310 nm	10Gbps	SONET or SDH	[redacted]
[redacted]						

4.2.15.4 OWS Quality of Service (L.34.1.4.6(d))

Figure 4.2.15-13 details Qwest's compliance with quality of service for OWS. Qwest complies with all of the required Acceptable Quality Levels (AQLs). [redacted] This is the result of the individual access and transport link availabilities, as well as the high availability of our deployed DWDM hardware. For Time To Restore (TTR), Qwest's approach for

monitoring and measuring performance indicators is consistent with the Government's requirement for OWS.

Figure 4.2.15-13. Qwest Compliance with Government OWS Performance Metrics

Key Performance Indicator (KPI)	Service Level	Performance Standard (Threshold)	Acceptable Quality Level (AQL)	[redacted]
Av(OWS over WDM)	Routine	99.9 percent	≥ 99.9 percent unprotected	[redacted]
	Critical [Optiona]	99.999 percent	≥ 99.999 percent	[redacted]
Time to Restore	Without Dispatch	4 hours	≤ 4 hours	[redacted]
	With Dispatch	8 hours	≤ 8 hours	[redacted]
Grade of Service (Restoration Time)	Routine	100ms	≤100ms	[redacted]
	Critical [Optiona]	60ms	≤ 60ms	[redacted]
BER	Routine	10^{-12}	≤ 10^{-12} at all times	[redacted]

[redacted]

4.2.15.5 Qwest's OWS Exceeds Service Requirements (L.34.1.4.6(e))

[redacted]

4.2.15.6 Experience with OWS Delivery (L.34.1.4.6(f))

Qwest has served OWS customers since [redacted] Qwest's OWS customers include Fortune 500

companies, carriers, and Federal Agencies[redacted]

4.2.15.7 Characteristics and Performance of Access Arrangements (L.34.1.4.6(g))

Qwest realizes that a key differentiator is the ability to ensure robust access not only to the traditional Incumbent Local Exchange Carriers (ILECs), but also to the diversity of Competitive Local Exchange Carriers (CLECs). This combination enables Qwest to leverage itself (as an ILEC in 14 states in the western U.S.), the other ILECs, and the CLECs to provide robust access solutions that meet our customers' needs.

Qwest has numerous access methods to reach our OWS backbone, including ILECs, CLECs, Qwest Local, Ethernet, Fixed Wireless, and Cable. We have procedures in place to provide real-time monitoring and performance statistics of these methods. We have strict guidelines on how we connect to LECs including dual entrance facilities, high capacity, and operations agreements.

[redacted] Qwest has the staff and procedures to engineer extremely high-availability access arrangements. [redacted]

Agencies expect the best possible provisioning intervals to achieve program benefits as soon as possible. Qwest has a long and excellent track record in on-time delivery service with reliable service delivery intervals.

[redacted] represents actual service turn-up from the customer's perspective—including all aspects of access, provisioning, demarcation extension, and equipment installation for a major Government department nationwide network.

[redacted]

This performance has direct benefits to Agencies. It means that Qwest has the ability to meet aggressive timelines for service transitions. [redacted]

Qwest uses our own and leased access facilities to connect customer locations to Qwest network services. In each case, Qwest network engineering and planning ensures that the access from our backbone to the

customer's location meets our standards and provides highest quality and reliable services.

[redacted]

4.2.15.8 Approach for Monitoring and Measuring OWS KPIs and AQLs (L.34.1.4.6(h))

Qwest's proven network architecture and performance measurement and monitoring procedures result in high availability for end users. Qwest monitors and measures the KPIs for AQLs using automated processes that pull data from its primary source, summarize it, and present the data in the Qwest Control Networx Portal. The Portal displays actual performance results. Results that meet performance goals are presented in green; results that do not meet performance goals are presented in red. Qwest completely

automates the process, from data collection to Web display, so that both Qwest and our customers stay focused on improving performance results rather than “report generation.” Process automation also establishes business rules and ensures that customers receive completely accurate performance data.

[redacted]

COT(HR) will be calculated based on ES and/or SES as defined by GR-253, G.826 through G.829 and will be expressed in Hours. Availability is computed by the standard formula:

Availability = RI(HR) – COT(HR)/RI(HR) x 100.

Qwest also maintains a central data repository for key network performance information [redacted] Qwest also uses collected performance data for these purposes:

[redacted]

Qwest maintains a central data repository for key network performance information. [redacted] Data is

analyzed, formatted, and sent to operations, engineering, and planning for pro-active network enhancement and capacity planning.

For all services that Qwest offers, we use the [redacted] trouble ticketing system. [redacted] is an industry-leading commercial-off-the-shelf application that we have customized to make more effective for our needs. From this system, we collect many useful metrics that we use internally to evaluate and improve our processes including TTR. The calculation for TTR uses the same business rules as the Government requires for its services.

Transparent Wavelength Performance (Req_ID 31428, C.2.5.4.1.4(2))

[redacted]

Support for In-Service Monitoring (Req_ID 31429, C.2.5.4.1.4(3))

Qwest's OWS is actively monitored 24x7x365 at our primary and backup Network Operations Center (NOC) facilities. [redacted] monitors each in-service wavelength for the full suite of SONET performance metrics such as AIS, ES, SES, and Code Violations. It also provides monitoring capabilities for the full suite of Ethernet performance metrics when configured to carry Ethernet traffic (10 GE).

Transparent Wavelength Performance (Req_ID 31539, C.2.5.4.2.4(2))

[redacted]

4.2.15.9 Quality of Service (L.34.1.4.6 (i))

OWS is a dedicated service that provides fixed bandwidth and a standardized [redacted] The service platforms introduce minimal latency and jitter (well within the required AQLs). As a consequence, it is ideal for supporting time-sensitive traffic as degradations to voice and video quality are minimal. Various SEDs provide different mechanisms for dealing with load conditions.

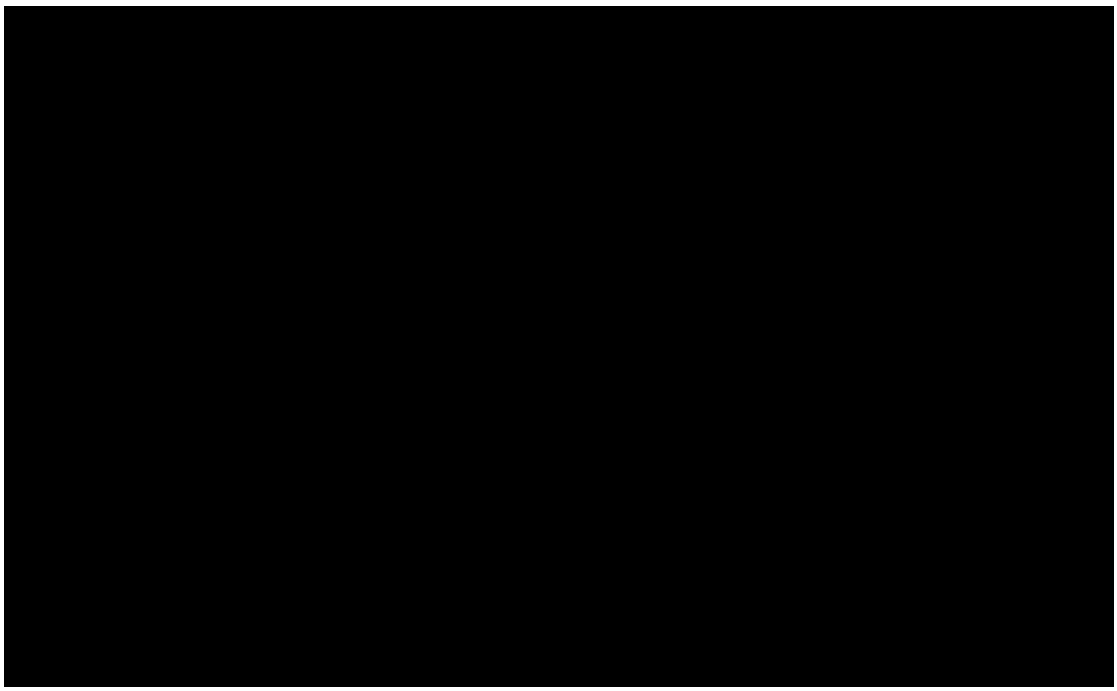
4.2.15.10 OWS Support for Integrated Access (L.34.1.4.6(j))

OWS provides a single high-bandwidth interface to the customer. This bandwidth is provided with a single performance level and is compliant with required AQLs. Integrated access for OWS may be implemented through different SEDs or by multiplexing the signal in the network to reach different applications within or outside the network (such as Private Line Service, Frame Relay Service, Voice, or Direct Internet Access). Multi-point connection, for example, provides flexibility to route different traffic to different service platforms within Qwest or at multiple Agency locations.

4.2.15.11 Infrastructure Enhancements and Emerging Services (L.34.1.4.6(k))

Qwest has mature processes that enable us to envision, research, evaluate, engineer, deploy, and operate new or emerging services. Driven initially by the Chief Technology Office, Qwest evaluates new products and technologies for incorporation into the Qwest network, in conjunction with Qwest Product Management. Qwest can satisfy all mandatory service requirements for OWS without enhancing the network. [redacted]

[redacted]



[redacted]

4.2.15.12 Approach for Network Convergence (L.34.1.4.6(l))

[redacted]

[redacted]

[redacted]

[redacted]

4.2.15.13 IP-PSTN Interoperability (L.34.1.4.6(m))

Qwest's OWS is already supporting transport of IP-enabled Public Switched Telephone Network (PSTN) traffic, ensuring interoperability.

4.2.15.14 Approach for IPv4 to IPv6 Migration (L.34.1.4.6(n))

Qwest's OWS transport of IP is L3 protocol-version independent.

4.2.15.15 Satisfaction of NS/EP Requirements (L.34.1.4.6(o))

According to RFP Section C.5.2.2.1, *NS/EP Basic Functional Requirements Matrix for Networx Services,* NS/EP requirements are not applicable to OWS. Details of how Qwest supports the 14 basic functional requirements for applicable services are provided in Section 3.5.1, *Approach to Satisfy NS/EP Functional Requirements*, in this Technical Volume.

4.2.15.16 Support for Signaling and Command Links (L.34.1.4.6(p))

This requirement does not apply to OWS as it does not touch the Signaling System 7 network or Satellite Command links.

4.2.15.17 Service Assurance in the National Capital Region (L.34.1.4.6(q))

As discussed in Section 3.2, *Approach to Ensure Service Quality and Reliability*, Qwest provides network services in the NCR with a robust network

architecture designed and engineered to ensure service continuity in the event of significant facility failures or catastrophic impact. Qwest will continue to engineer critical services to meet each Agency's requirements to eliminate potential single points of failure or overload conditions that may impact their network service performance.

[redacted] Qwest also provides functionality that enables Government Emergency Telecommunications Service priority calling mechanisms.

Qwest will provide full NS/EP Functional Requirements Implementation Plan (FRIP) documentation upon contract award when requested to proceed with plan delivery. Qwest will update plans, including Part B addressing our strategy for supporting Agency NCR requirements in accordance with RFP Section C.7.16.

Qwest understands the Government's requirement to assure performance of network services in and around the NCR. [redacted] Each of these gateways provides complete redundancy to access Qwest nationwide and international network capabilities as well as regional voice and data services.

Qwest has recently acquired OnFiber, a metro SONET and Ethernet provider with yet another diverse network in the NCR. This gives Qwest at least [redacted] fiber optic networks to use to ensure redundancy and survivability in the greater Washington D.C. area.

[redacted]

[redacted] shows the logical configuration of the major transport facilities as well as the services provided at each POP.

[redacted]

[redacted] Fortifying our DWDM approach with diverse ILEC and CLEC entrance facilities to our POPs increases network resiliency and ensures that a catastrophic event, such as the failure of the infrastructure supporting the POP, [redacted]

As presented in Section 3.2.2, *Arrangements with Other Service Providers for Carrying and Exchanging Traffic*, Qwest connects to [redacted] ILEC POP locations through fiber interconnected protected networks to ensure multiple access paths to ILEC services, including voice termination. The use of CLECs, which provide infrastructure that is generally separate from the ILECs, gives another level of resiliency to the architecture because these services would not be affected by an ILEC facility failure.

The route-diverse fiber backbone and access networks that service the NCR enable the transport of services to any Qwest POP nationwide.

Qwest will address the strategy, technical systems, and administration, management, and operation requirements for the NCR in part B of our NS/EP FRIP (a draft appears as Appendix 15 to Qwest's Networx Management proposal).

4.2.15.18 Approach to Satisfying Section 508 Requirements (L.34.1.4.6(r))

According to RFP Section C.6.4, *Section 508 Provisions Applicable to Technical Requirements*, Section 508 provisions are not applicable to OWS. Qwest has fully described our approach to satisfying Section 508 requirements for applicable, offered services in Section 3.5.4, *Approach for Meeting Section 508 Provisions*, of this Technical Volume.

4.2.15.19 OWS Impact on Network Architecture (L.34.1.4.6(s))

The delivery of optional service OWS has no impact on the network architecture of the underlying wavelength network. Qwest's OWS network was purpose-built to deliver wavelengths across the U.S. Since the service is mature and there is no change to the OWS network, it is unlikely that any adverse security, quality, reliability, or performance issues would arise. The Qwest OWS network has been operating at a high level of performance for more than five years and has all major routes already incorporated into the network as well as capacity to support OWS transport requirements well into the future. The network will continue to evolve as customer needs change.

Security: Since Qwest is proposing to use dedicated OWS capacity to fulfill Agency requirements, security on the network is very high. There is no concept of hacking on a physical layer service, and any tapping into the line would be intrusive and detected immediately by Qwest's NOC.

Quality: Since the OWS service is provisioned on dedicated full-time physical circuits at 2.5 and 10 Gbps, there is no need for any classes or Quality of Service levels. Each customer circuit has its own dedicated path between two endpoints.

Reliability: The OWS service rides the reliable Qwest dedicated and owned network where availability is consistently high. The OWS service benefits from the same NOC that manages all Qwest SONET and Private Line Services, so that sparing, alarms, and technicians are all common and consistently deliver a highly reliable service.

Performance: The OWS service meets or exceeds all relevant performance criteria since Qwest provides a dedicated path or paths from termination to termination on a dedicated dual-rail network. The OWS service easily meets the standards set forth in the RFP.

4.2.15.20 Optimizing the Engineering of OWS (L.34.1.4.6(t))

The wavelength network is optimized [redacted] This work is performed primarily by Qwest's Provisioning and Current Planning groups. These groups are dedicated to ensuring that Qwest's state-of-the-art network is used to its fullest potential. When a circuit is designed, Qwest ensures that the shortest route is chosen. In addition, Qwest uses a route that contains the least amount of hand-offs between different systems. A circuit is handed-off between different systems only when required. These practices not only ensure that the network is used optimally, but that it also provides Agencies the least amount of latency on their circuit. Furthermore, this activity attempts to reduce the number of potential points of failure for a given circuit.

4.2.15.21 Vision for Service Internetworking (L.34.1.4.6(u))

[redacted]

[redacted]

4.2.15.22 Support for Government OWS Traffic (L.34.1.4.6(v))

Qwest has analyzed the traffic model provided and determined that supporting all of the circuits needed by the Government would only increase utilization on the current Qwest network [redacted] Qwest currently has sufficient capacity to handle all traffic forecast in the OWS traffic model [redacted] Qwest does expect Networx traffic to exceed the numbers in the model and is prepared to effectively handle such demand.

Qwest closely monitors network use to develop trended growth patterns. The trended growth data drives Qwest's decisions regarding initiation of new builds. If the Government's actual demand for OWS exceeds the Government forecast level, Qwest is prepared to make the necessary investment to augment capacity as needed.